(No Model.) 3 Sheets—Sheet 1.

W. DOWNS & A. H. BLACKBURN.

FEED WATER HEATER.

No. 572,247. Patented Dec. 1, 1896.

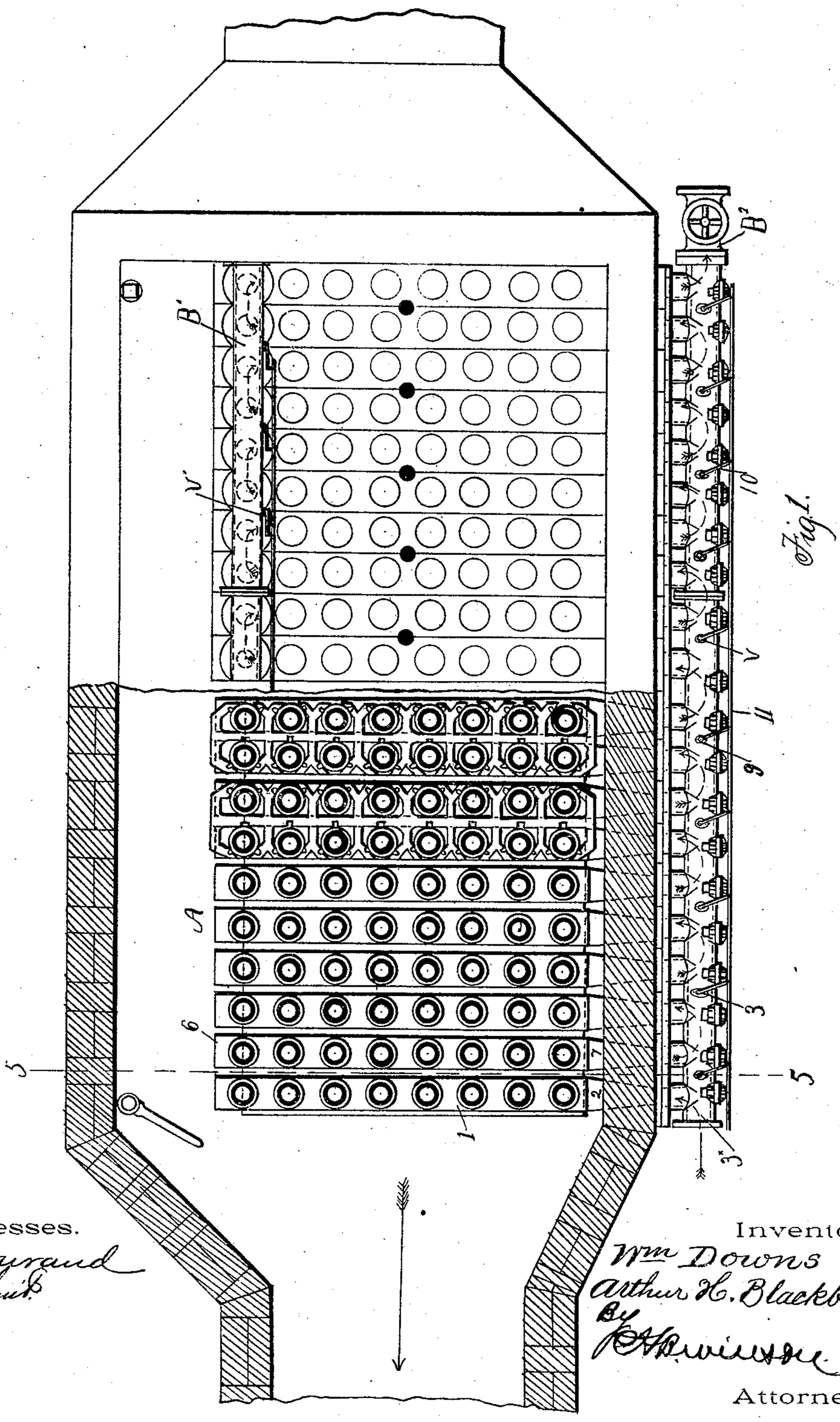


Fig. 1.

Witnesses.
F. L. Ourand
R. B. Smith

Inventors
Wm Downs
Arthur H. Blackburn
By
Attorney.

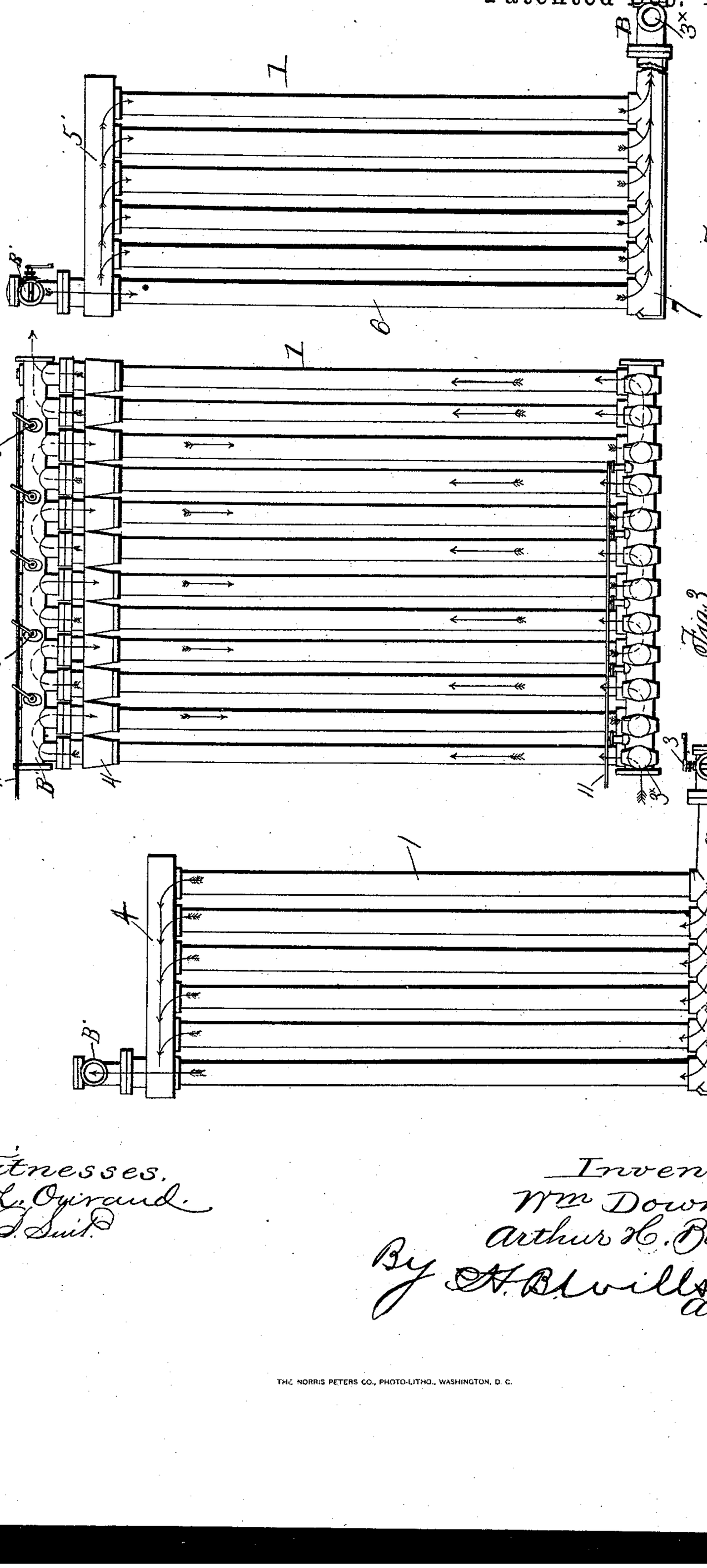
(No Model.)

3 Sheets—Sheet 2

W. DOWNS & A. H. BLACKBURN.

FEED WATER HEATER.

No. 572,247. Patented Dec. 1, 1896.



Witnesses.
F. L. Ogirand.
A. G. Smith

Inventors
Wm Downs
Arthur H. Blackburn
By A. B. Willson.
Attorney

(No Model.) 3 Sheets—Sheet 3.

W. DOWNS & A. H. BLACKBURN.

FEED WATER HEATER.

No. 572,247. Patented Dec. 1, 1896.

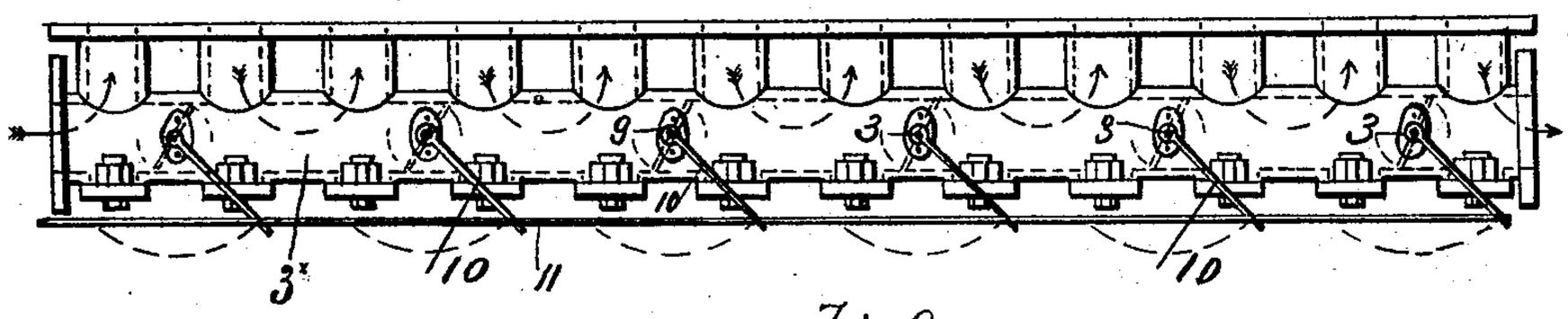


Fig. 6.

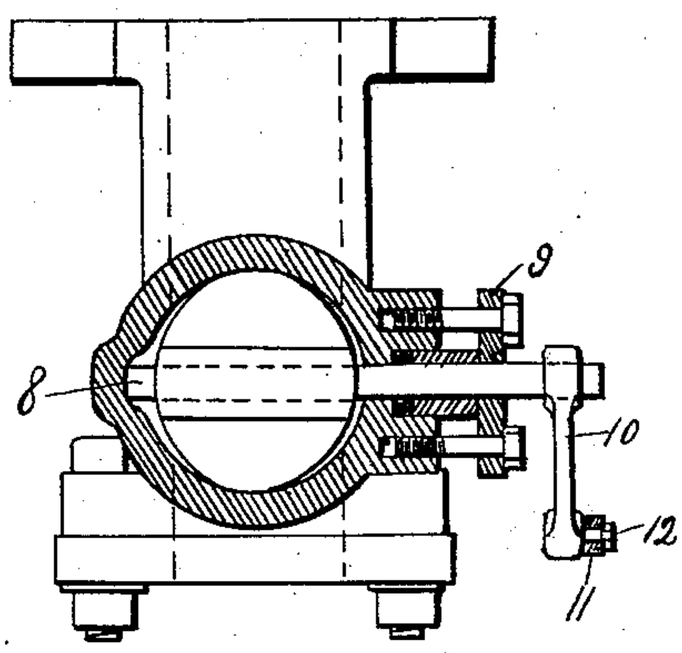


Fig. 7.

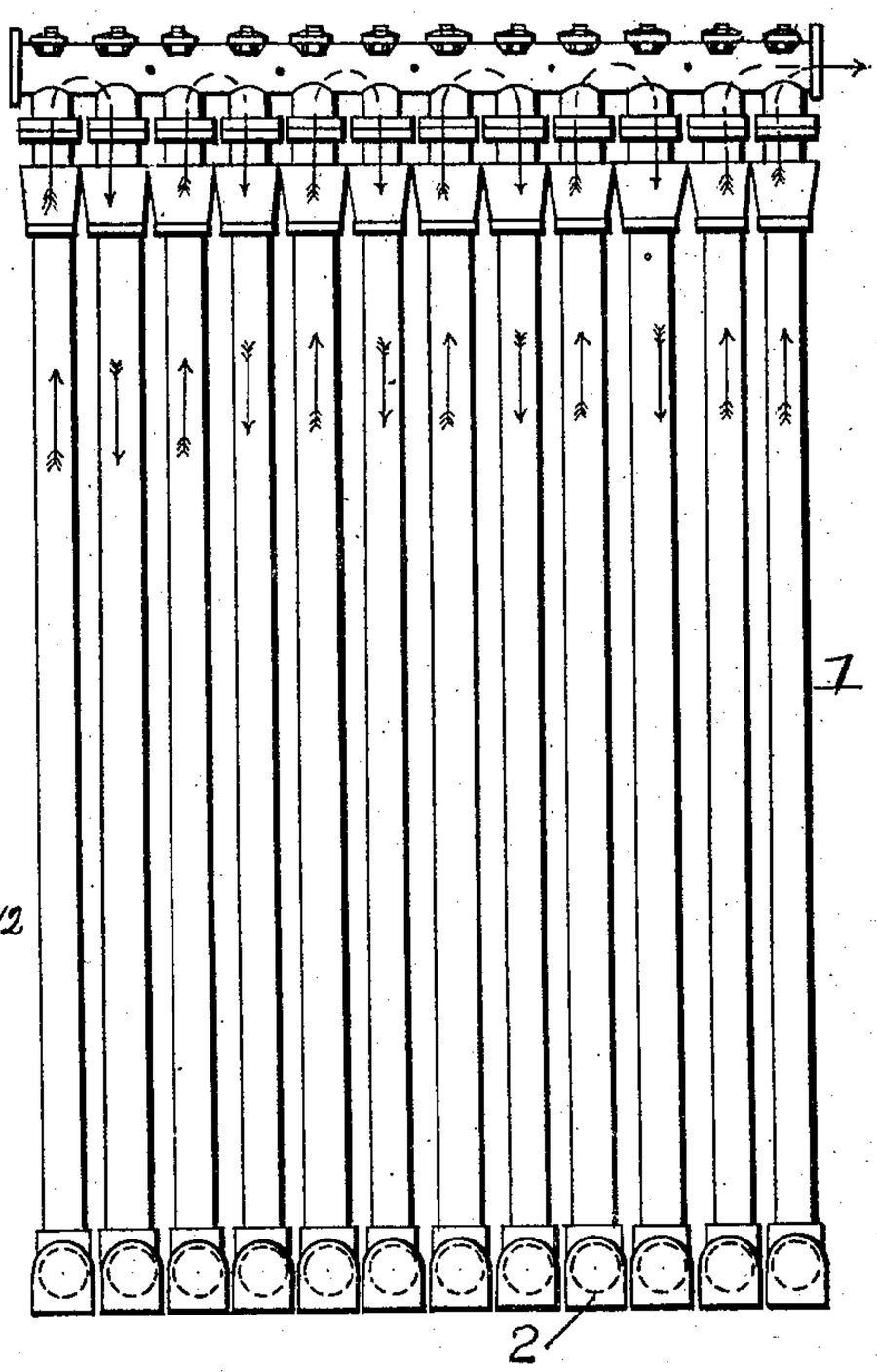


Fig. 4.

Witnesses.
F. L. Oyrand
A. D. Smith

Inventors
Wm Downs
Arthur H. Blackburn
By J. H. Merrillson.
Attorney.

UNITED STATES PATENT OFFICE.

WILLIAM DOWNS, OF NEW YORK, AND ARTHUR HENRY BLACKBURN, OF MATTEAWAN, NEW YORK.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 572,247, dated December 1, 1896.

Application filed May 18, 1896. Serial No. 592,021. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM DOWNS, residing at New York, in the county of New York, and ARTHUR HENRY BLACKBURN, residing at Matteawan, county of Dutchess, State of New York, subjects of the Queen of Great Britain, have invented certain new and useful Improvements in Feed-Water Heaters or Fuel-Economizers; and we do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention has relation to improvements in feed-water heaters or fuel-economizers; and the object is to provide an apparatus of the kind named provided with improved novel means for creating and cutting off the circulation of the water through the nest or series of communicating pipes, as will be hereinafter fully described, and particularly pointed out in the claims.

We accomplish the objects of the invention by the means illustrated in the accompanying drawings, forming a part of this specification, and wherein—

Figure 1 is a plan view, partly in horizontal section, showing the general construction of the apparatus. Fig. 2 is an end elevation. Fig. 3 is a front elevation, partly in section. Fig. 4 is a rear elevation. Fig. 5 is an end elevation, partly in section, on the line 5 5 of Fig. 1. Fig. 6 is a plan view of the header-pipe, showing the location and arrangement of the valves therein. Fig. 7 is a transverse section through the header-pipe, showing one of the wing-valves mounted therein with an operating-arm.

In the usual construction of feed-water heaters or fuel-economizers they are made with only natural circulation; but we are aware that fuel-economizers have been made and provided with valves of other constructions than those involved in the present invention, our invention enabling the economizer to be used either as a positively-circulating apparatus or as a natural circulating one, with full communication throughout the nest of pipes, and also enables the apparatus to be blown off with one main blow-off valve by simply opening the wing-valves, which are arranged to open either in unison or separately, so that, if desired, part of the economizer can be worked circulating and part non-circulating.

Referring to the drawings, A designates the nest of pipes of a fuel-economizer, consisting of any number of tiers of metal pipes. The first tier 1 of the pipes have their lower ends opening into a feeder-pipe 2, the supply being controlled by a stop-valve 3 in the supply-pipe $3^{\times}$. The pipes 1 all communicate with and lead into a top pipe 4, the course of the water being indicated by the arrows, whereby it will be perceived that the water rises simultaneously upward in all the pipes in the tier. At the rear end the pipe 4 feeds into the top pipe 5 of the next tier 6 of pipes, into which the water descends to the bottom pipe 7 of the tier, and thence through the blow-off pipe B into the next adjacent tier of pipes, as indicated in the drawings, and so on, coursing up one tier and down the other throughout the series of tiers.

B designates the combined access feed and blow-off header or pipe, located at the lower end of the economizer at the front thereof and having communication with all the tiers, and at the upper end, at the rear of the apparatus, is the top delivery header or pipe B′, having communication with all the tiers, except as hereinafter specified, when the valves are closed to convert the economizer into a positively-circulating device.

In the pipe B is journaled a number of wing-valves V, the first of which is disposed to shut off the water from entering beyond the first or end tier of pipes and serving to turn or deflect the water into those pipes, as shown, and then the others of the series are arranged at intervals embracing or including two sets of tiers or pipes, so that the water coming through the first of the set so included will be turned into the second of the series included between any two valves. In the pipe B′ are arranged the same construction or style of valves V′, the first of which is disposed between the second and third tiers of pipes, as shown, and the others arranged at intervals embracing two tiers of pipes, so that the water discharged from the first is directed to the second. The two sets of valves are disposed in alternation rela-

tively to each other, as shown in the drawings.

The valves are essentially of the wing variety, and consist of metal disks fitted suitably in the pipes, and mounted on journals or stems 8, let through guides or caps 9, and carrying on their outer ends arms 10, the free ends of which are detachably connected to a valve-rod 11, so that they can all be opened and closed by a single movement of the valve-rod, or so that by removing the pivot-screw 12, which holds the arms to the valve-rod, any number of the valves may be opened, that part of the economizer converted into a natural circulating apparatus, and the balance of it be used as a positively-circulating apparatus.

To use the apparatus as a positively-circulating one, the valves are all closed, and then the water will be directed back and forth across the apparatus, flowing up one tier and down the other; and if it is desired to convert the apparatus into a non-circulating economizer the valves are all opened.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. In a fuel-economizer or feed-water heater, the combination with the nest of pipes, the feed-pipe 2 connected with one tier thereof, the top pipe 4 communicating with the other end of the pipes of said tier, a top pipe 5′ communicating with the top pipe 4 and with one end of the nest of pipes of another tier, a bottom pipe 7 at the opposite end of the pipes of the last-named tier, a blow-off pipe B communicating with the bottom pipe 7, the combined access and blow-off pipe B^2 having communication with all the tiers of pipes at one end, the top delivery header or pipe B′ having communication with the opposite ends of all the tiers of pipes, and valves alternately disposed in the feed-pipe and the delivery-pipe, whereby the apparatus may be converted from a non-circulating into a positive circulating apparatus.

2. In a fuel-economizer or feed-water heater, the combination with the nest of pipes, the feed-pipe 2 connected with one tier thereof, the top pipe 4 communicating with the other end of the pipes of said tier, a top pipe 5′ communicating with the top pipe 4 and with one end of the nest of pipes of another tier, a bottom pipe 7 at the opposite end of the pipes of the last-named tier, a blow-off pipe B communicating with the bottom pipe 7, the combined access and blow-off pipe B^2 having communication with all the tiers of pipes at one end, the top delivery header or pipe B′ having communication with the opposite ends of all the tiers of pipes, and valves alternately disposed in the feed-pipe and the delivery-pipe, arms on the stems of the valves, and a valve-rod on the free ends of the arms, whereby the valves may be opened and closed in unison.

3. In a fuel-economizer or feed-water heater, the combination with the nest of pipes, the feed-pipe 2 connected with one tier thereof, the top pipe 4 communicating with the other end of the pipes of said tier, a top pipe 5′ communicating with the top pipe 4 and with one end of the nest of pipes of another tier, a bottom pipe 7 at the opposite end of the pipes of the last-named tier, a blow-off pipe B communicating with the bottom pipe 7, the combined access and blow-off pipe B^2 having communication with all the tiers of pipes at one end, the top delivery header or pipe B′ having communication with the opposite ends of all the tiers of pipes, and valves alternately disposed in the feed-pipe and the delivery-pipe and formed with stems, arms in the ends of the stems, and a valve-rod detachably connected to the ends of the arms, whereby some or all of the valves may be operated by the valve-rod.

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

WM. DOWNS.
ARTHUR HENRY BLACKBURN.

Witnesses as to Wm. Downs:
C. L. ROCKWELL,
GEO. F. WETMORE.

Witnesses as to A. H. Blackburn:
PAULL J. CHALLEN,
G. KNAPP.