No. 780,565. PATENTED JAN. 24, 1905.

A. H. HUMPHREY.

WATER HEATER.

APPLICATION FILED JUNE 26, 1900.

2 SHEETS—SHEET 1.

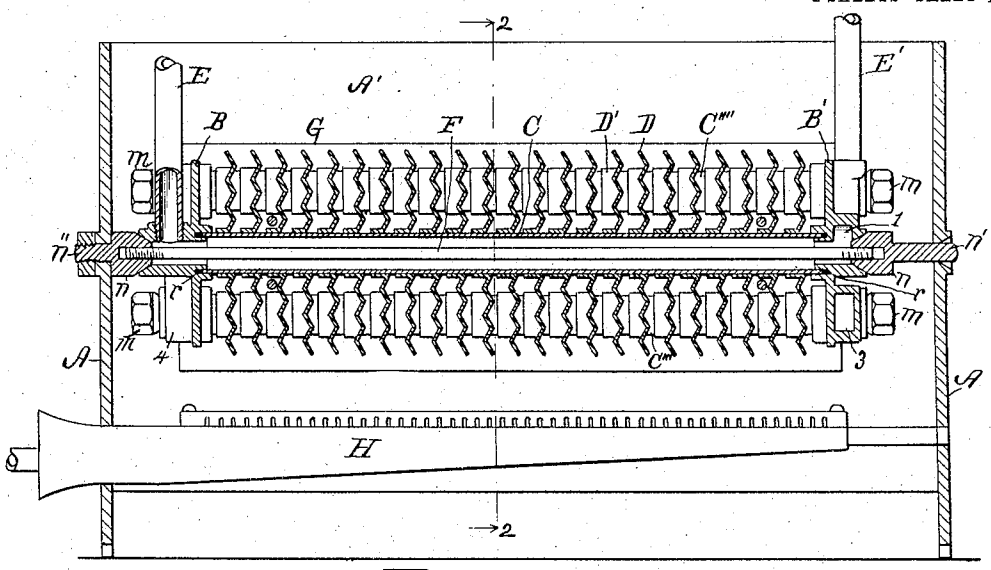

Fig. 1

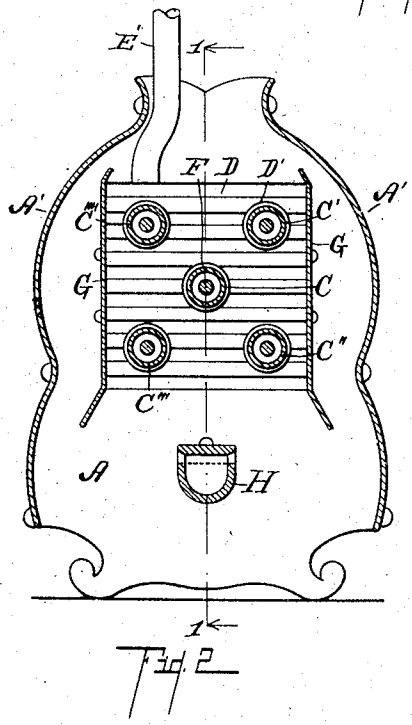

Fig. 2

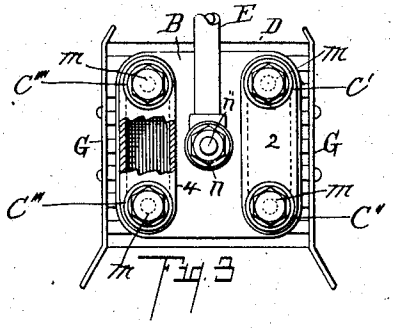

Fig. 3

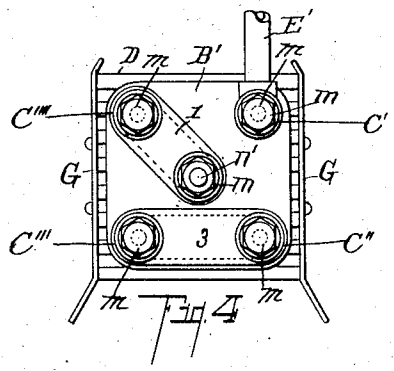

Fig. 4

Witnesses:

S. A. Earl.

Otis A. Earl

Inventor,

Alfred H. Humphrey

By Fred L. Chappell

Att'y.

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A. H. HUMPHREY.

WATER HEATER.

APPLICATION FILED JUNE 26, 1900.

2 SHEETS—SHEET 2.

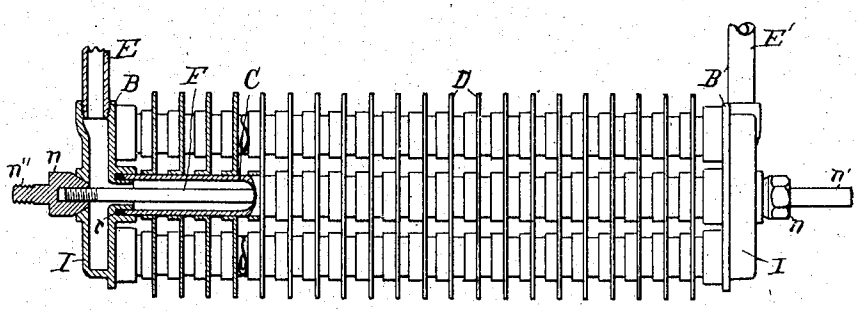

Fig. 5

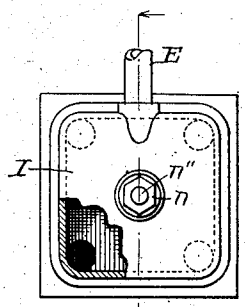

Fig. 6

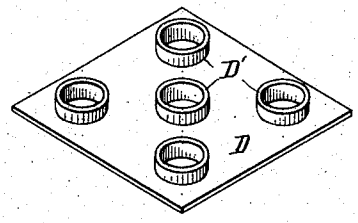

Fig. 7

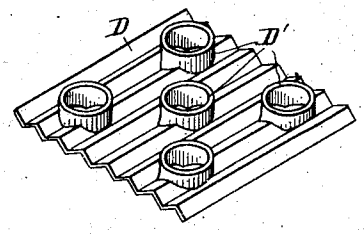

Fig. 8

Witnesses:

S. A. East.

Otis A. Ward

Inventor,

Alfred H. Humphrey

By Fred L. Chappell

Att'y.

No. 780,565. Patented January 24, 1905.

UNITED STATES PATENT OFFICE.

ALFRED H. HUMPHREY, OF KALAMAZOO, MICHIGAN.

WATER-HEATER.

SPECIFICATION forming part of Letters Patent No. 780,565, dated January 24, 1905.

Application filed June 26, 1900. Serial No. 21,692.

To all whom it may concern:

Be it known that I, ALFRED H. HUMPHREY, a citizen of the United States, residing at the city of Kalamazoo, in the county of Kalamazoo and State of Michigan, have invented certain new and useful Improvements in Water-Heaters, of which the following is a specification.

This invention relates to improvements in water-heaters.

It relates to a heater especially adapted for use with gas as a fuel, though I am aware that other burners or means might be provided in connection with the remaining parts. The heater is of the kind commonly known as "instantaneous."

The objects of my invention are, first, to provide an effective means for delivering the heat of the burner to a current of water passing through the heater or to any water or liquid contained in the heater; second, to provide an improved construction and arrangement of parts whereby a compact and efficient heater is produced which can be manufactured at light expense and with the use of a very small amount of material; third, to provide an improved construction of water-circuit through a heater which utilizes tubes without bending and which is so arranged that the heater is easy to clean; fourth, to provide an improved heat-absorbing plate and connection therefor to the tubes forming the water-receptacle of the heater; fifth, to provide an improved construction and arrangement of parts of the heater whereby the heat from the burner will not cause uneven expansion and contraction to wrench the joints or strain the connections; sixth, to provide an improved construction and connection of the tubes forming the circuit which permits of the easy support of the parts in the casing; seventh, to provide an improved form of burner for use in this connection. Further objects will definitely appear in the detailed description to follow.

I accomplish the objects of my invention by the devices and means described in this specification.

The invention is clearly defined, and pointed out in the claims.

A structure embodying the features of my invention is clearly illustrated in the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a vertical longitudinal detail sectional elevation on line 1 1 of Fig. 2 through a heater embodying the features of my invention, the burner being shown in full lines. Fig. 2 is a transverse vertical detail sectional elevation taken on line 2 2 of Fig. 1. Fig. 3 is a detail end elevation of the water-receptacle and adjacent parts removed from the main casing of the machine, the view being taken from the left-hand end of Fig. 1, a portion being shown in section. Fig. 4 is a similar detail end elevation taken from the right-hand end of Fig. 1. Fig. 5 is a detail side elevation of a modified construction of water-receptacle, partially in section on line 5 5 of Fig. 6. Fig. 6 is a detail end elevation from the left-hand end of Fig. 5, a portion being shown in section. Fig. 7 is a detail view of one of the absorbing-plates appearing in Fig. 5. Fig. 8 is a detail view of one of the corrugated absorbing-plates appearing in the preferred construction shown in Fig. 1.

In the drawings all of the sectional views are taken looking in the direction of the little arrows at the ends of the section-lines, and similar characters of reference refer to similar parts throughout the several views.

Referring to the lettered parts of the drawings, A is the main or outer casing, which serves as a support for the remaining portions of the device. The case in general contour is elongated and rectangular, the upper walls A′ A′ being curved inwardly to form a restricted passage along the top of the casing for the escape of the products of combustion. The side walls are raised considerably above the floor or platform on which the device may be placed to permit a free entry of air to supply the burner. The receptacle or passage for the water is made up of a series of tubes C C′ C″ C‴ C⁗, preferably five in number, which are connected together by a manifold at each end. This manifold is preferably formed by a connection, one from the central tube C to the upper left-hand tube C′, which appears in Fig. 4. The tube C′ is connected to the

tube C″ directly below it at the opposite end, as appears in Fig. 3. The two bottom tubes C″ and C‴ are connected by a chamber 3, (see Fig. 4,) and the opposite end of tube C‴ is connected by the connection 4 to tube C⁗, as appears in Fig. 3. Suitable caps *m* are provided opposite the ends of each tube, so that they can be readily opened for cleaning. These caps are screw-threaded and engage the ends of tie-rods which hold the manifolds in position. A rod F extends through the center tube C and is retained by tapered nuts *n n*, screwed onto the same, as appears in Fig. 1. The end of the nut *n* at the left hand of Fig. 1 is reduced in size and is screw-threaded at its outer end at *n*″ to receive a suitable nut. This reduced portion is inserted through the end of the casing A and the nut screwed on as a retaining device. The nut *n* at the right-hand end of Fig. 1 is reduced and formed into a smooth round pin, which projects through a perforation in the case, where it is allowed to move freely back and forth, which is desirable on account of the expansion and contraction due to the variations in temperature of the water-receptacle within. This pin *n*′ is of considerable length, so that the water-receptacle can be moved far enough to the right to withdraw the pin *n*″, when by dropping the same downward the water-receptacle can be easily removed or inserted.

Supported on these tubes C C′ C″ C‴ C⁗ are a series of plates D, which are preferably corrugated and are provided with little collars or sleeves D′, which embrace and contact closely with the walls of the tubes, the same being forced to position under pressure or otherwise tightly fitted, and it is sometimes found desirable to make the union more perfect by soldering. This is conveniently done by dipping in a tin or similar bath. To each side of these plates, which are allowed to project beyond the tubes laterally, I secure plates G G, the lower edges of which flare outwardly and project beneath the lower edges of the plates. To the free end of the central tube C is connected an inlet water-pipe E, and to the outer or free end of the tube C⁗ is connected the delivery-pipe E′, so that a current of water entering at E will circulate through all the pipes successively. A burner H is provided in the lower part of the casing, which is a long tapering tube flattened on its upper side and provided with perforations for the escape of the gas. The particular form that I have shown grades the pressure so that the different burner-apertures receive an even pressure, which causes an even flame beneath the heater.

In operation the burner is lighted and the water turned on at E. The heated products of combustion rise upwardly through the plates, the horizontal corrugations deflecting it from side to side, so that the plates absorb the heat and deliver it to the water or liquid in the tubes C C′ C″ C‴ C⁗. This is so effective that a comparatively large stream of water passing therethrough will be heated substantially to the boiling-point, and as the apparatus itself contains a very small amount of material there is no loss in waiting for the apparatus to heat up. When the gas and water are shut off simultaneously and the temperature of the plates tested, they will be found to be comparatively cool, which indicates the high efficiency of the heat absorption.

I have thus far described the preferred construction. In Figs. 5, 6, and 7 I show a somewhat modified and cheaper construction and one particularly adapted for use as a circulating-heater, as a free flow of the water is there desirable. In this structure the manifolds embrace all of the tubes; but a single tie-rod—namely, the rod F at the center—is used, and the heat-absorbing plates are made flat, as appears at K in Figs. 5 and 7 with the collars or sleeves D′ to embrace the tubes. This is a very efficient heater and on account of its cheapness and the unobstructed flow of the water is adapted for many uses. The delivery and discharge pipes are arranged the same as before and are connected to the manifolds B and B′, respectively.

I have described the parts constituting my improved water-heater very minutely, and I desire to state that the same can be greatly varied without departing from my invention. I have already stated that any style of burner or heat-generator might be used to deliver a current of heated air or gases to the casing. The number of tubes forming the water receptacle or passage can be varied, and the form of the absorbing-plates and the connection of the same to the tubes is also capable of variation, as well as the form of manifolds. In fact, manifolds might be dispensed with and the pipes coiled or bent; but such structure would not be so desirable in some particulars as the one I have shown. It would be impossible to illustrate all of these modifications, so I do not attempt it. I show the form I consider most practical and another economical form. I consider the particular form shown to possess advantages over any other, and therefore I wish to claim the structure both specifically and broadly.

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

1. In a water-heater, the combination of an outer casing A open at the top and bottom; a burner arranged in the bottom of said casing; a water-receptacle above said burner, consisting of the central tube C, and the tubes, C′ C″, C‴ and C⁗ arranged about said central tube; a manifold B at one end having chambers 2 and 4 connecting the tubes C′, and C″, C‴, and C⁗ respectively, and a manifold B′ at the opposite end having chambers 1 and 3 connecting the tubes C, and C′ and C″, and C‴, respectively; rods extending through said

tubes and manifolds with screw-threaded nuts *n n* for clamping the same together, one of said nuts being extended into a bolt and the other into a pin, to extend through the casing to support the same; a supply-pipe connected to the central tube C through the manifold B; a discharge-pipe E′ connected to the free end of the tube C′′′′ through the manifold B′; a series of corrugated plates D having sleeves D′ fitting the said pipes and arranged parallel and substantially vertical between the said manifolds; and side plates G G, secured to the lateral edges of the plates G and extending downwardly and outwardly beneath the same to guide the heat upward between the plates, all coacting substantially as described and for the purpose specified.

2. In a water-heater, the combination of an outer casing A open at the top and bottom; a burner arranged in the bottom of said casing; a water-receptacle above said burner, consisting of the central tube C, and the tubes C′, C′′, C′′′ and C′′′′ arranged about said central tube; a manifold B at one end having chambers 2 and 4 connecting the tubes C′, and C′′, C′′′, and C′′′′ respectively, and a manifold B′ at the opposite end having chambers 1 and 3 connecting the tubes C, and C′ and C′′, and C′′′ respectively; rods extending through said tubes and manifolds with screw-threaded nuts *n n* for clamping the same together, one of said nuts being extended into a bolt, and the other into a pin, to extend through the casing to support the same; a supply-pipe connected to the central tube C through the manifold B; a discharge-pipe E′ connected to the free end of the tube C′′′′ through the manifold B′; a series of corrugated plates D having sleeves D′ fitting the said pipes and arranged parallel and substantially vertical between the said manifolds, all coacting substantially as described and for the purpose specified.

3. In a water-heater, the combination of an outer casing A open at the top and bottom; a burner arranged in the bottom of said casing; a water-receptacle above said burner, consisting of the central tube C, and the tubes C′, C′′, and C′′′ and C′′′′ arranged about said central tube; a manifold B at one end having chambers 2 and 4 connecting the tubes C′, and C′′, C′′′, and C′′′′ respectively, and a manifold B′ at the opposite end having chambers 1 and 3 connecting the tubes C, and C′, and C′′, C′′′, respectively; rods extending through said tubes and manifolds with screw-threaded nuts *n n* for clamping the same together, one of said nuts being extended into a bolt and the other into a pin, to extend through the casing to support the same; a supply-pipe connected to the central tube C through the manifold B; a discharge-pipe E′ connected to the free end of the tube C′′′′ through the manifold B′; a series of plates D having sleeves D′ fitting the said pipes and arranged parallel and substantially vertical between the said manifolds, all coacting substantially as described and for the purpose specified.

4. In a water-heater, the combination of the casing A open at its top and bottom; a burner arranged in the bottom of said casing; a water-receptacle above said burner, consisting of the central tube C and the tubes C′, C′′, C′′′, and C′′′′, arranged about the same; manifolds at each end of said tubes; a supply-pipe connected to one of said manifolds, a discharge-pipe connected to the opposite manifold; and a series of plates D having sleeves D′ fitting the said pipes and arranged parallel and substantially vertical between the said manifolds, all coacting substantially as described and for the purpose specified.

5. In a water-heater, the combination of a suitable casing; a series of separated horizontal tubes connected together by suitable manifolds arranged within the casing; a series of vertical plates transverse to said tubes and connected therewith by suitable collars; a supply-pipe and a discharge-pipe connected to said tubes; and a burner so arranged that the heat therefrom will pass up between the plates and tubes, for the purpose specified.

6. In a water-heater, the combination of a series of separated horizontal tubes suitably connected together; a series of vertical plates transverse to said tubes and connected therewith by suitable collars; a supply-pipe and a discharge-pipe connected to said tubes; and a burner so arranged that the heat therefrom will pass up between the plates and tubes for the purpose specified.

7. In a water-heater, the combination of a series of separated horizontal tubes suitably connected together; a series of vertical plates containing corrugations, transverse to said tubes and connected therewith by suitable collars; a supply-pipe and a discharge-pipe connected to said tubes; and a burner so arranged that the heat therefrom can pass up between the plates for the purpose specified.

In witness whereof I have hereunto set my hand and seal in the presence of two witnesses.

ALFRED H. HUMPHREY. [L. S.]

Witnesses:
A. E. HOUGHTON,
OTIS A. EARL.