

No. 892,613.

PATENTED JULY 7, 1908.

O. D. ORVIS.  
DOWNDRAFT FURNACE.  
APPLICATION FILED AUG. 3, 1907.

4 SHEETS—SHEET 1.

FIG. 4

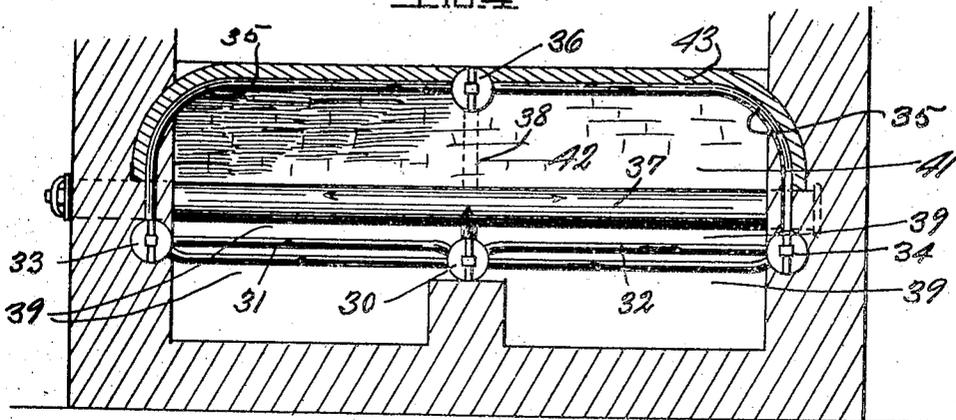
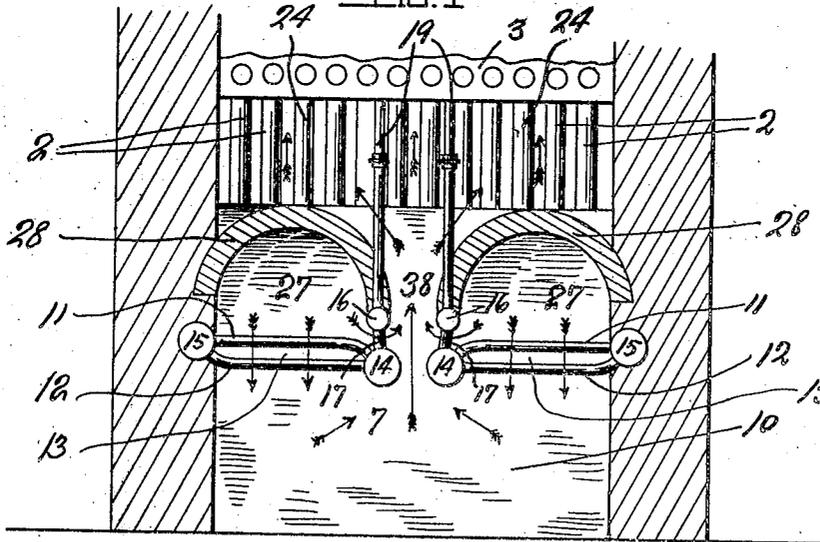


FIG. 1



Witnesses  
W. Riemann  
Chas. Gessert

O. D. Orvis Inventor

By his Attorney  
Ivan E. G. Springberg

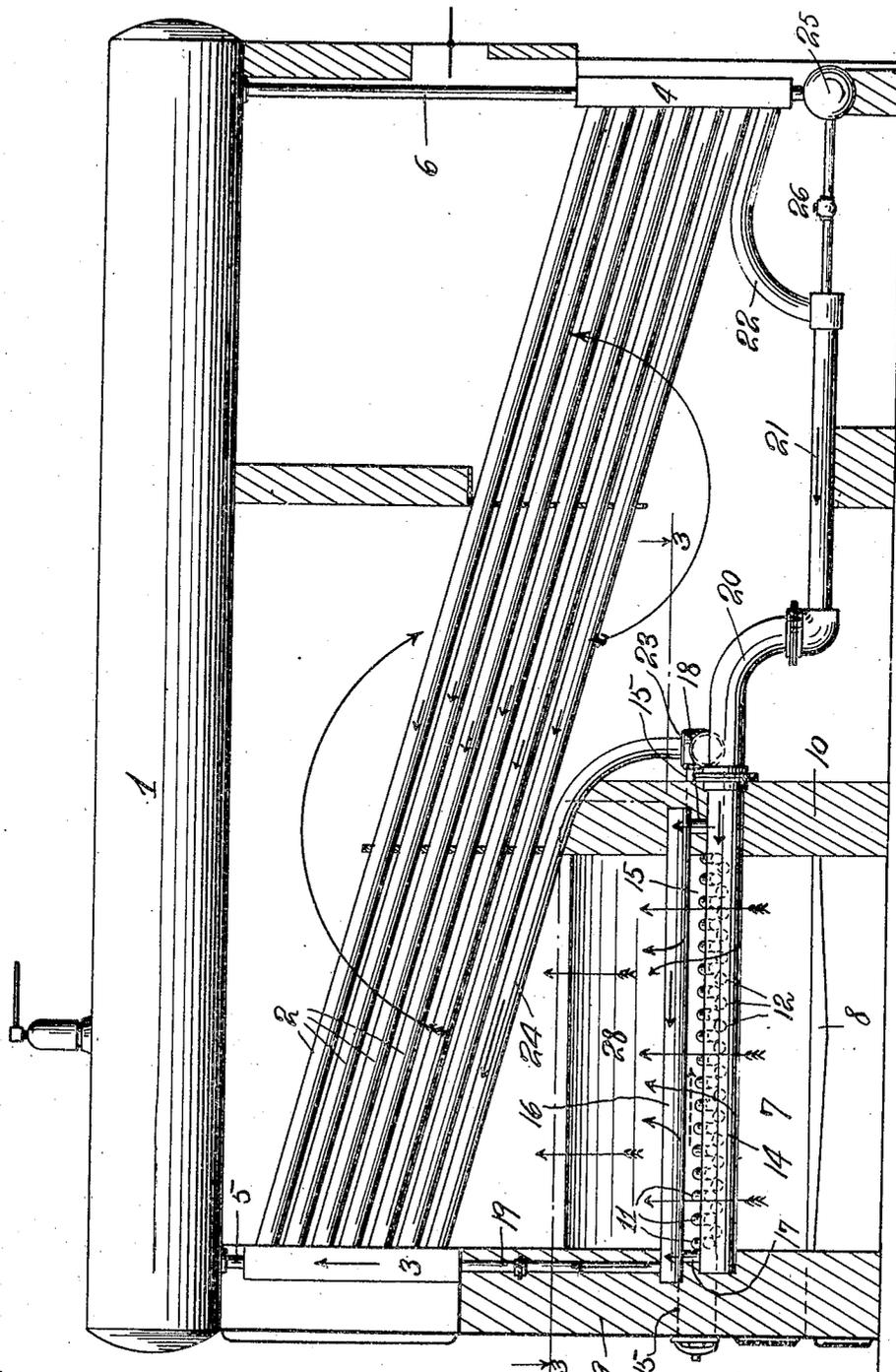
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4 SHEETS—SHEET 2.

FIG. 2



Witnesses  
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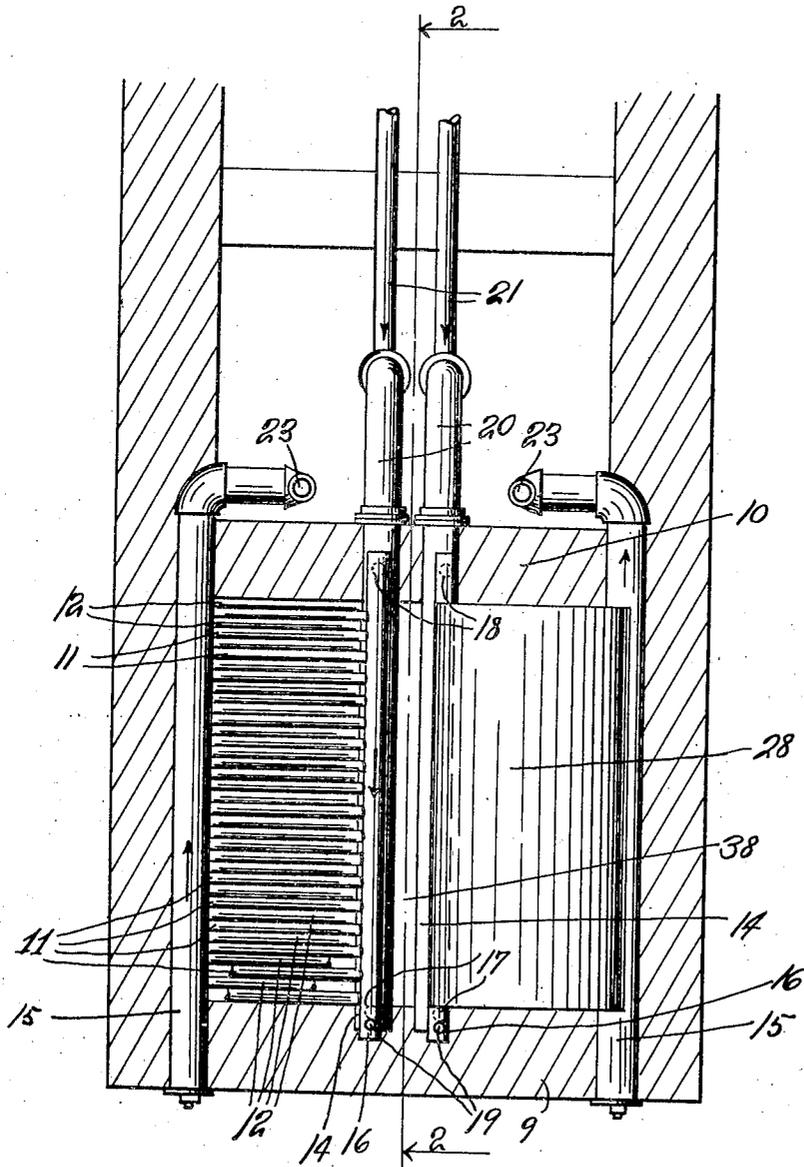
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4 SHEETS—SHEET 3.

FIG. 3



Witnesses  
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Inventor

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Ivan E. A. Hornigberg

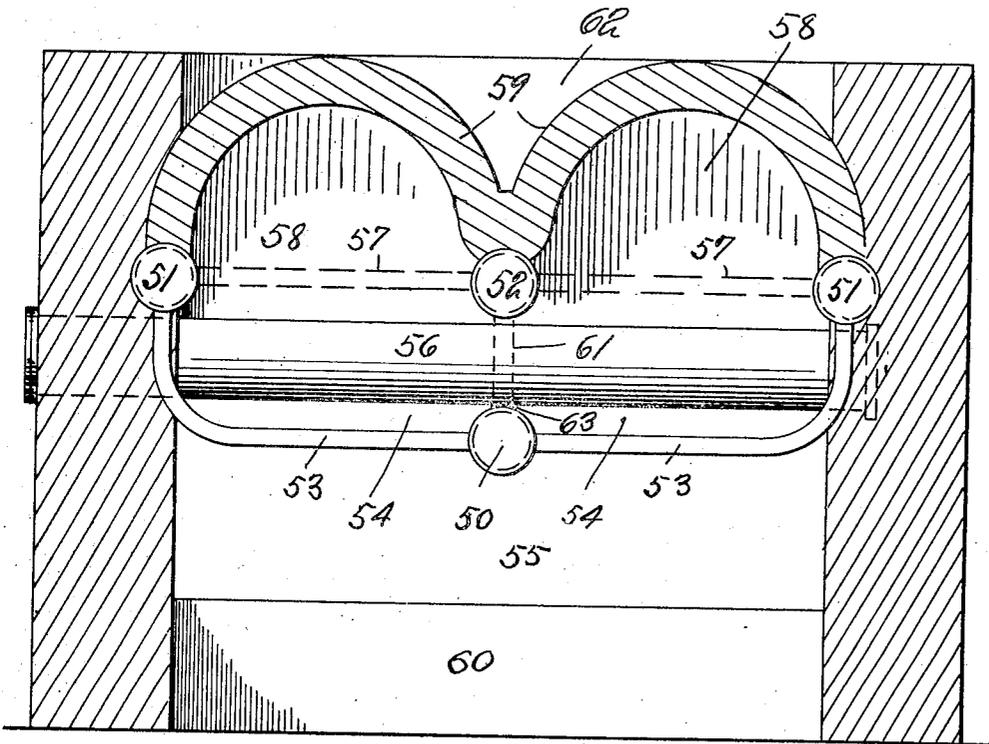
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4 SHEETS—SHEET 4.

FIG. 5



Witnesses  
W. Riemann  
Chas. F. Gessert

O. D. Orvis Inventor  
By *[Signature]* Attorney  
Ivan E. A. Koenigsberg

# UNITED STATES PATENT OFFICE.

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## DOWNDRAFT-FURNACE.

No. 892,613.

Specification of Letters Patent.

Patented July 7, 1908

Application filed August 3, 1907. Serial No. 386,946.

*To all whom it may concern:*

Be it known that I, OREL D. ORVIS, a citizen of the United States of America, and a resident of Jersey City, Hudson county, State of New Jersey, have invented certain new and useful Improvements in Downdraft-Furnaces, of which the following is a specification.

This invention relates to down draft furnaces and has particular reference to a down draft furnace for use in connection with a water tube boiler.

The object of the invention is to so construct a furnace, that the advantages of the down draft system may be fully utilized for a water tube boiler.

The invention is embodied in the construction as set forth in the following specification and illustrated in the accompanying drawing and comprises such features, arrangements of parts and elements as will hereinafter more fully appear in details, and the novelty of which is pointed out in the claim.

In the said drawings: Figure 1 is a sectional elevation of a down draft furnace right back of the boiler front with parts omitted. Fig. 2 is a longitudinal section on line 2—2 of Fig. 3 showing the brick arch in place. Fig. 3 is a plan view in section taken substantially on line 3—3 of Fig. 2 and Fig. 4 is a sectional view showing modification. Fig. 5 is a similar view of another modification.

In the said drawings the numeral 1 denotes the boiler proper, 2 are the inclined tubes, expanded into the front and rear headers, denoted by 3 and 4 respectively, and connected by pipes 5 and 6 to the boiler as usual.

7 indicates the fire box above the lower grate 8 and extending from the front wall 9 to the fire brick wall 10. Above the said fire box I provide the down draft or upper grate which in the present instance is shown as consisting of two halves, one right and one left, and which each comprises the water tubes 11 and 12 which are placed at two different levels as shown and between which is formed a space 13. The tubes extend transversely from the center headers 14 to the side headers 15, both of which run longitudinally and into which the tubes 11 and 12 are expanded and staggered.

Above the headers 14 are smaller headers

16 connected to the former by the front and rear connections 17 and 18 and connected to the front header 3 by the vertical pipes 19. The headers 14 connect with the circulating system of the boiler by being connected to the rear header 4 by the connections 20, 21 and 22; and the headers 15 connect at 23 with inclined pipes 24 leading to the front header 3.

From the connection 21 a pipe leads to the mud drum 25 and is provided with a check valve 26 which normally is closed, but will open when the mud drum is opened for cleaning, thus providing a clear blow off for the system.

Above the upper grates are formed retorts 27 by means of fire brick arches 28, which cover the fire box except at the center where a passage 38 is formed.

I will now describe the operation.

The fire rests on the water grate in the retorts 27 and the lower grate only receives whatever drops down from the upper one, and the space 13 between the two layers of water tubes serves as a sort of cleaning chamber, as it is only necessary to thrust a flat tool into this space to effectively and quickly clean the fire. The gases gather in the retorts 27 and are consumed there and the pure hot combustible then passes down through the fire and up in the center space 38 and from thence up through the inclined pipes and out. The path of the combustible or heat is indicated by arrows with feathers, while the circulation of the water is indicated by plain arrows. The water passes from the boiler down to the rear header 4 and then up through the inclined pipes, but part of it follows the connections 22, 21 and 20 to the side headers 15, from which it passes through the water grate to header 14, then through connection 17 and 18 to header 16, then along under the arch, and up through 19 to the front header 3 and back to the boiler.

It will be noted that I have provided an upper water grate of large area with the result that the water circulates very rapidly through the tubes, quickly is turned into steam, hence the efficiency of the boiler is increased and by reason of the retort and the down draft smokelessness is obtained, so

that by the above described construction a large circulating and heating surface is added to the boiler without changing the construction thereof very much, while practical experiments have shown this invention to produce the desired results of fuel economy, quick steaming and almost perfect combustion. It will also be noted that the headers are of generous size and that all the work is easily accessible for cleaning or repairs.

In Fig. 4 I have shown a modified construction for use where the furnace is very wide. In this instance the principle of the above described construction is adhered to but in different form. In this instance the header 30 is connected up to the rear header of the boiler by connections similar to the connections 20, 21 and 22 above described and from this header the water passes into the water grates 31 and 32 to either side, then into side headers 33 and 34 and up through the bent tubes 35, 35 to an upper central header 36 and from there back to the boiler. At the rear end the lower header 30 is connected to a transverse header 37 which communicates by pipe 38 with header 36. The fire brick wall 41 is supported on this transverse header 37 so that passages 39 are formed, through which the combustible escapes to the interior of the furnace. The retort 42 is formed under the arch 43 extending from side to side.

In Fig. 5 I have illustrated another modification in case where, by the use of an extended front, greater grate surface is required. In this instance the longitudinal header 50 is connected directly to the rear boiler header. From this header 50 the water passes to the side headers 51 through the water grates 53, the side headers being connected to the front boiler header. Arched retorts as 58 are formed by means of the brick arches 59, which rest in the center on the header 52 connected by pipes 57 to headers 51 and also connected behind the brick wall by pipe 61 to header 50. The rear end of these arched retorts 58 are closed by the wall 62, which in this instance corresponds to the firebrick wall 10 above referred to, and which rests on and is supported by the header 56 at the rear of the grate and extends upward to a height about equal to the height of the extended furnace front. The header 56 is connected to the header 50 by connection 63. Passages as 54 are formed for the path of the combustible which also passes down and back to the boiler. 55 indicates the lower fire box and 60 is the lower part of the fire brick wall. Also in these instances it will be seen that a large heating surface is carried and provision made for rapid circulation of the water.

It is thought that the above fully describes my invention and the operation thereof, but

I am not to be limited to the precise construction shown.

I claim:

1. In a down draft furnace the combination of a boiler, inclined water tubes, side headers connected to said tubes, central headers connected to said boiler, arches supported on said central headers, other central headers, a water grate formed between the latter and the said side headers, connections between said central headers, the said water grate comprising a plurality of water tubes located at different levels and expanded into the last mentioned central headers and the said side headers, and connections between said central headers and the water tubes of the boiler.

2. In a down draft furnace the combination with a water tube boiler, a fire box, an upper and lower grate, said upper grate comprising horizontal water tubes placed at two levels forming a narrow cleaning space between them, longitudinal central and side headers into which the said tubes are expanded in staggered position, retorts formed above said upper grate by means of fire brick arches having an up draft passage between them, and connections between said central headers and said boiler and between said side headers and said water tubes of said boiler.

3. In a down draft furnace the combination of a water tube boiler having inclined tubes, of a front and rear header for said tubes, a fire box, a lower grate, an upper water grate comprising a double layer of horizontal water tubes expanded into headers, which latter are placed in parallel position to that of said boiler, fire brick arches, the inner edges of which are supported on the last mentioned headers and connections for bringing said water grate and all of said headers into the circulating system of said boiler.

4. In a down draft furnace the combination of a boiler, inclined water tubes, side headers connected to said tubes, central headers connected to said boiler, arches supported on said central headers, other central headers, a water grate formed between the latter and said side headers and consisting of a double layer of staggered water tubes, having a space between the two layers of water tubes which latter are placed at right angles to the last mentioned central headers and expanded into the same and into said side headers, and connections between said central headers and the water tubes of the boiler.

Signed at New York, N. Y., this 1 day of Aug., 1907.

OREL D. ORVIS.

Witnesses:

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FREDERICK C. HUNTER.