

No. 688,417.

Patented Dec. 10, 1901.

E. H. HOVEY & E. P. GLEASON.  
FUEL ECONOMIZER.

(Application filed Dec. 18, 1900.)

(No Model.)

2 Sheets—Sheet 1.

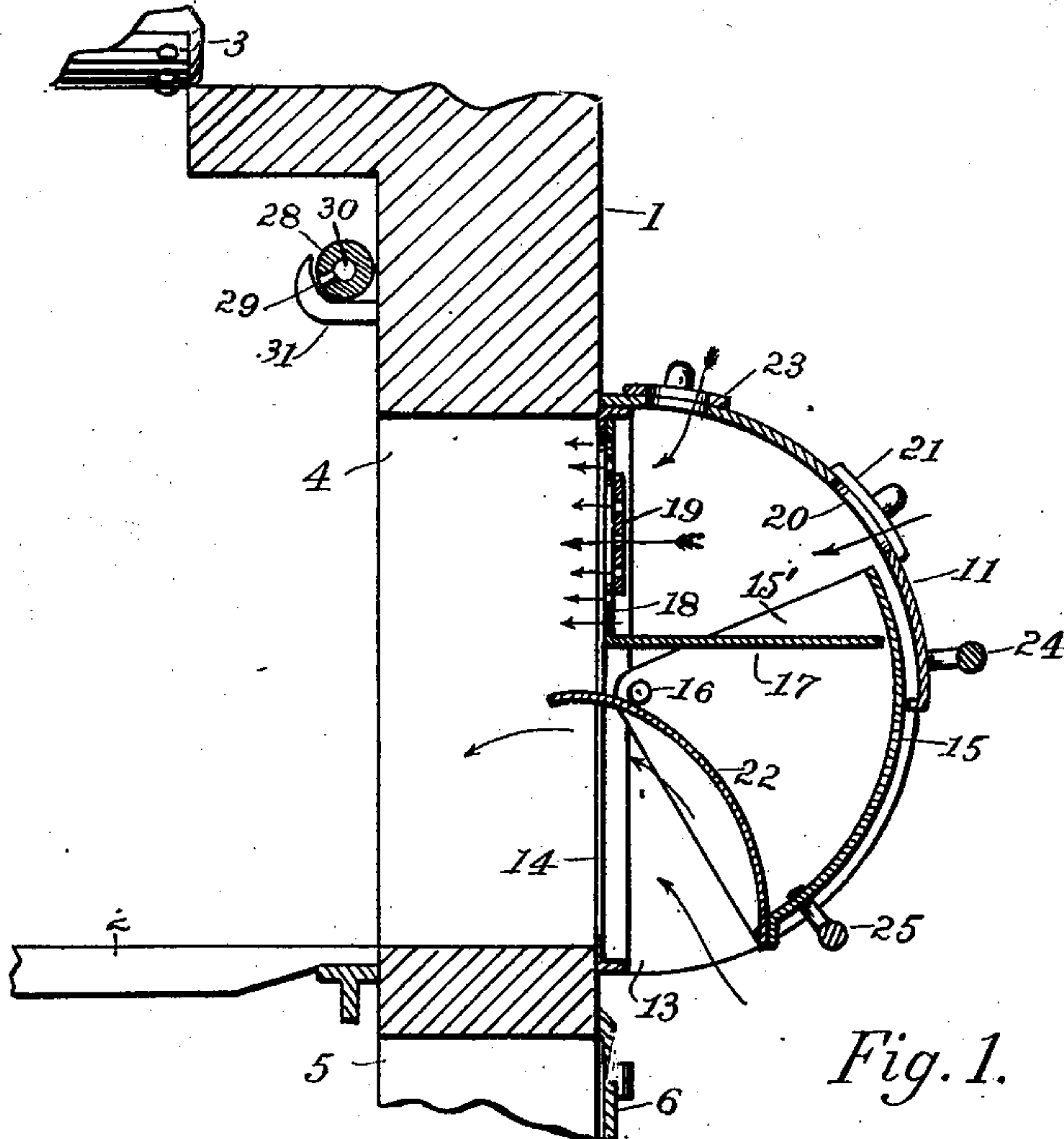


Fig. 1.

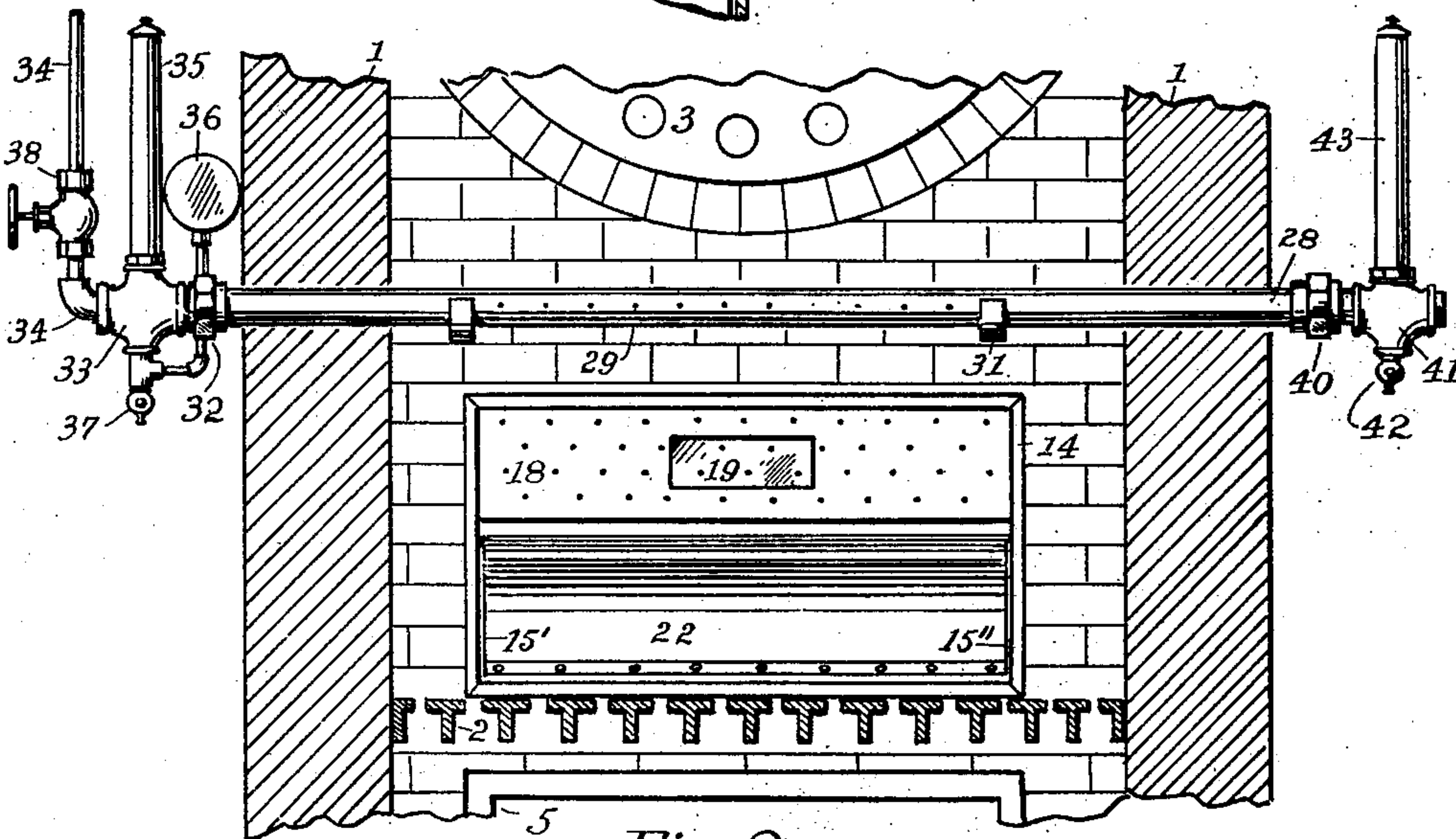


Fig. 2.

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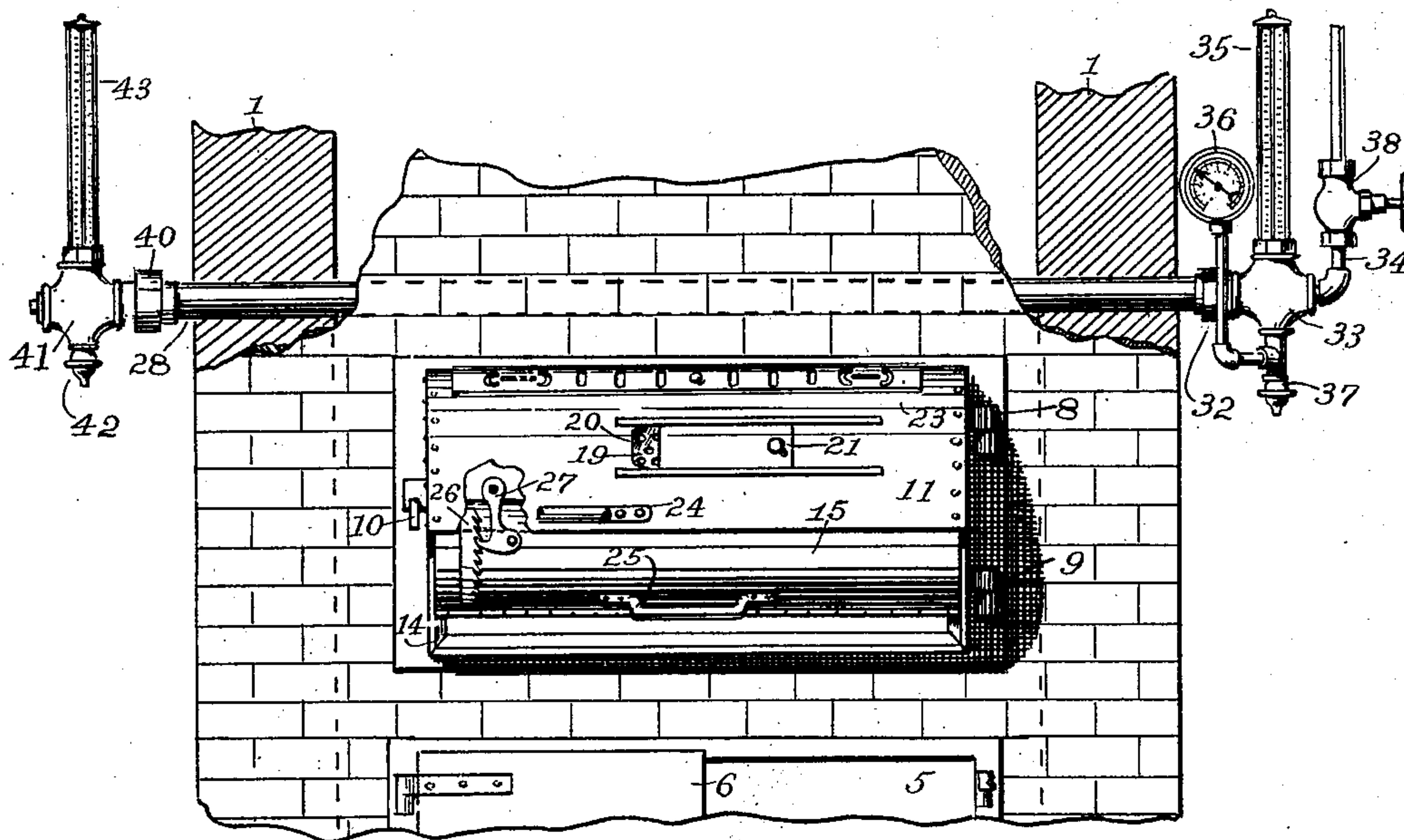


Fig. 3

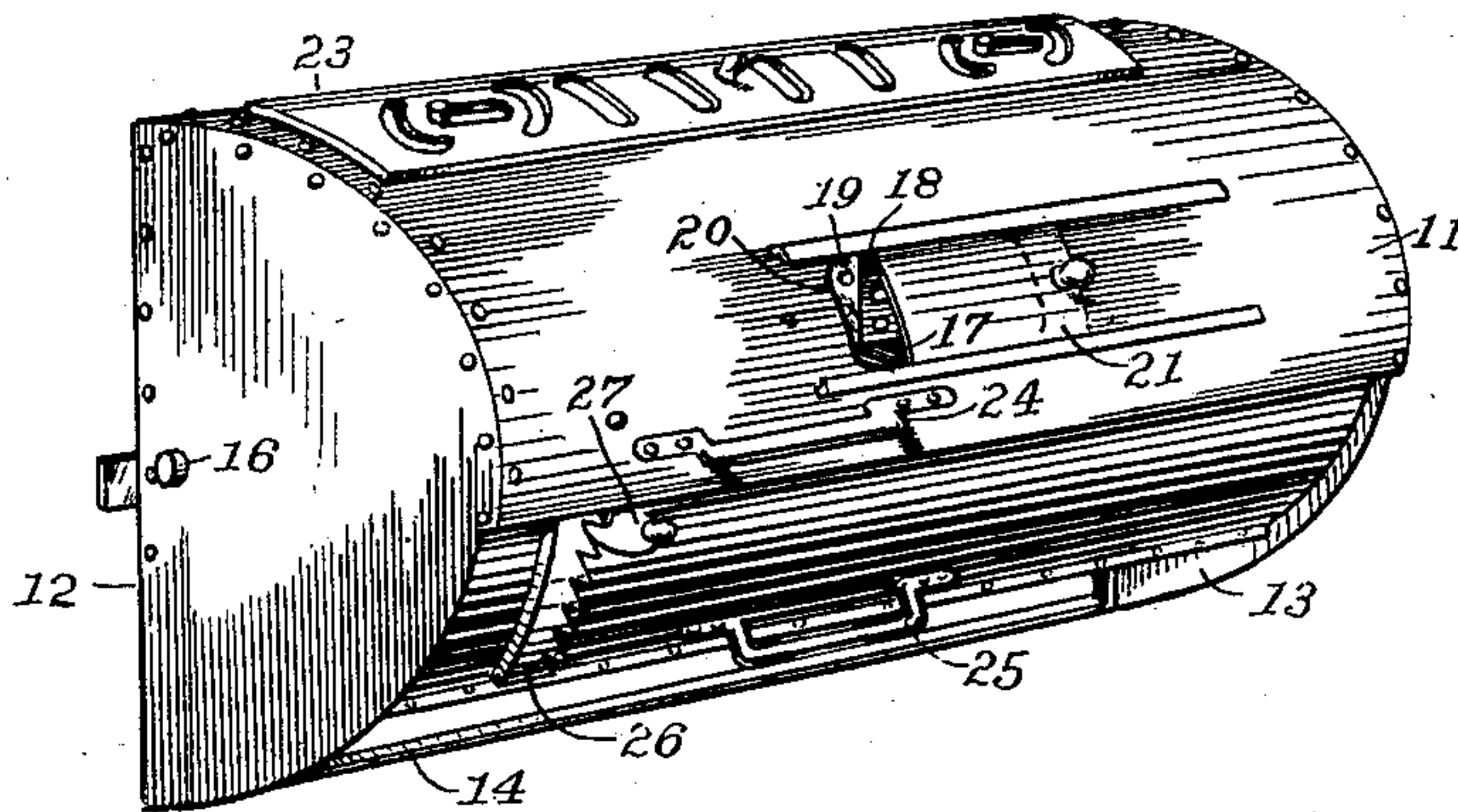


Fig. 4.

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# UNITED STATES PATENT OFFICE.

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## FUEL-ECONOMIZER.

SPECIFICATION forming part of Letters Patent No. 688,417, dated December 10, 1901.

Application filed December 18, 1900. Serial No. 40,233. (No model.)

*To all whom it may concern:*

Be it known that we, EDDY H. HOVEY and ELLIOTT P. GLEASON, citizens of the United States, and residents of the borough of Brooklyn, New York city, in the county of Kings and State of New York, have invented certain new and useful Improvements in Fuel-Economizers, of which the following is a specification.

10 Our invention relates to improvements in attachments to steam-boiler and other furnaces for preventing the creation of smoke when bituminous coal, refuse, or other fuel is used in which an excessive amount of carbon is produced during combustion; and it  
15 consists of a furnace-door and retort for superheating steam, both of which may be easily attached to or detached from a furnace, the object being to provide a smoke-preventing  
20 device which is simple and effective and which can be attached to a boiler or furnace for a few hours or over night, if required, so no interruption occurs in the working of the furnace during ordinary working hours to which  
25 it is applied.

Another object of the invention is a simplification of a device for a similar purpose specified in the pending application of the hereinbefore-named Eddy H. Hovey, filed April 25,  
30 1900, Serial No. 14,235.

Reference being had to the accompanying drawings, which form part of this specification, Figure 1 is an enlarged central sectional view embodying our improvements. Fig. 2  
35 is a transverse view of Fig. 1 as seen from the inside of a steam-boiler furnace. Fig. 3 is a front view, partly in section, and Fig. 4 is a perspective view, of our improved door.

Similar numbers of reference refer to similar parts in the several views.

1 is the conventional fire-brick work of a furnace, in which grate-bars 2 are placed in the usual manner. 3 is the steam-boiler. 4 is the opening for the passage of fuel, &c. 5 is the  
45 ash-pit opening, and 6 is the door for the same. These parts are all such as are commonly used and therefore employed in this specification to simplify description.

Our improved device is attachable to sectional boilers of such type as the "Babcock &

Wilcox," "Hines," and others and to upright boilers such as the "Climax," "Hazelton," and the like, the attachments then requiring only slight modifications in the method of attaching, as will be evident to one versed in  
55 the art.

The furnace-door of our improved construction has usual hinges 8 9 on one end and a latch 10 at the other or free end. The outer portion of the door is a semicylindrical casing  
60 11, having its two ends closed by semicircular plates 12 13, which plates and outer casing 11 are fastened together at their adjoining edges by an angle-iron suitably curved to the arc  
65 of the circle. The inner face of the door is a foraminous frame 14, formed of angle-iron mitered on the inner web to form the corners. The upper edge of outer casing 11 and the straight inner edges of plates 12 13 are  
70 riveted to the angle-iron, this construction resulting in the production of a light but rigid door. The outer casing 11 is stationary. The inner curved door 15 turns about a line at the center of the cylinder.

15' and 15'' are segmental plates fastened  
75 to the side edges of the circular section 15. These plates are pierced at the proper place for the passage of the rod 16, which rod is pivoted in the side plates 12 13, at the center of the cylinder of which, the front of the door,  
80 parts 11 15 form a part.

17 is a horizontal plate extending across the door from near the outer casing to the inner frame 14, where it is turned upward at right angles and forms the perforated shield 18,  
85 which is riveted to the inner web of the frame 14. About centrally of the perforated shield is placed a transparent piece of mica 19 or other suitable high-heat-resisting material, which is also perforated. Its position opposite a peep-hole 20, with a sliding cover 21, in the casing 11 affords a ready means for observing the action of our complete device when in full operation.

The inner curved door 15 turns up inside of  
95 the outer casing 11, between it and the outer edge of the plate 17, as shown in Fig. 1. The inner curved door is provided with a curved plate 22, secured to the lower edge of the casing 15 and extending upward and onward to  
100



the rod 16, to which it is fastened by screws or otherwise, then bending slightly downward with a less curve and extending a short distance inward from said rod.

5 A gridiron-damper 23 in the upper part of the outer casing permits regulation of a quantity of air to be admitted to the interior of the door-casing. If required, a supplemental quantity can be supplied through the peep-  
10 hole 20 by opening the sliding door 21. The ingoing air is heated, thus tending to keep plate 18 and door from becoming excessively hot by carrying the heat off into the furnace.

24 is a handle for opening the door, and 25  
15 is a handle whereby curved inner door can be raised or lowered for regulating quantity of air.

As will be seen by referring to Figs. 3 and 4, the inner curved door has a saw-toothed ratch  
20 26 fastened sidewise on the periphery near one end. A pawl 27 engages the teeth of the ratch, holding door 15 in any position in which it is set. We find in practice that when a ratchet-wheel and pawl such as is shown  
25 and described in application Serial No. 14,235, now pending, is used on a furnace where the latch-nosing is nearly central it interferes with the proper working of the door, and alterations must be frequently made to permit  
30 its free operation.

By the use of our improved ratch-and-pawl adjustment the means for regulating supply of air to furnace is on the front, in view of the fireman, and in no manner interferes  
35 with the latch-nose on the boiler-front. This construction permits the instant positioning of a door constructed as described on the door-frame of a furnace from which a common door has just previously been removed.  
40 To permit the fireman to see the condition of his fire, a peep-hole having a sliding cover 21 is placed on the outer casing 11. On a straight horizontal line opposite the peep-hole is the transparent shield 19, hereinbefore  
45 mentioned.

Superheated steam is supplied to the fire-chamber by means of the retort 28, preferably made of a composite cast-iron, round in cross-section, the retort being directly ex-  
50 posed to the intense heat of the furnace. A series of holes 29 in a straight row is drilled through the retort to communicate with the passage 30, which runs through its center. The retort is supported on the brackets 31,  
55 secured in the brickwork, the brackets being driven in just far enough to permit the retort to revolve for adjustment for the purpose hereinafter described. To place retort in position, a hole is drilled in the side of the brick-  
60 work opposite and in a line with brackets. A swivel-union 32 or other coupling to permit retort to be revolved for adjustment is used on the inlet end of retort. Into this fitting a cross 33 of special construction may be  
65 screwed. Into the cross on the "run" opposite retort a pipe 34 is screwed, which takes steam from the dome of the boiler or else-

where where dry steam can be obtained. In the upper opening of the cross a thermometer 35 may be placed for the purpose of read- 70 ing the temperature of the steam entering the retort, it being obvious that the mercury-bulb must be in the path of the steam. In the lower opening of the cross a steam-pressure gage 36 or a petcock 37, or both, may be con- 75 nected. A valve 38 to control amount of steam fed to the retort is placed in the supply-pipe 34. On the other end of the retort a union-coupling 40 can be used, and another cross 41, in all respects similar to the one used 80 on the inlet end, can be made use of, the object being to read the difference in temperature of the steam after passing through the retort. A petcock 42 in bottom of the cross opposite the thermometer 43 will permit es- 85 cape of superheated steam, which in passing acts on the mercury and shows its temperature. The purpose of using swivel or union couplings between retort and pipe is that in practice we find it difficult to predetermine 90 at what angle the superheated jets of steam should issue from the retort to get the most economical and best results. In some furnaces the jets are required to shoot out in an almost horizontal line and in other furnaces 95 the retort must be turned so that the holes will point down in an almost vertical line. This variation is required by difference in height of doors and retort, distance of boiler above the grate-base, draft, and other condi- 100 tions to be found in the various steam-boilers and their settings. By having the retort revoluble the direction given to the jets of superheated steam is optional, and any desired angle can be given to them by revolv- 105 ing the retort from the outside of the boiler, even while in active operation, the peep-hole in the door affording a means for observing the result.

Such being the construction, the operation 110 is as follows: When the retort and the improved door are in place and necessary steam connections are made, the fire in the furnace is started in the usual way. When sufficient steam has been generated—say ten pounds— 115 the valve is turned on slowly, and steam is permitted to enter the retort, where it is immediately superheated and discharged through the perforations. The inner door 11 is adjusted so that the proper quantity of air is 120 given to the fire, the curved plate 22 giving a proper direction to the air-currents entering the opening at bottom, as shown by arrows. If more air is required, the gridiron-damper 23 and the sliding door 21 are opened. 125 When the retort is turned so that a proper angle is given to the superheated steam issuing from the holes, a partial vacuum is formed, and when the steam-pressure is increased to, say, twenty pounds and the adjustable door 130 and retort are properly adjusted in relation to each other the mixed gases impinge against the fuel and while increasing the draft prevent the formation of smoke. The proper



quantity of air and superheated steam can be positively determined upon by observation through the peep-hole and transparent shield and the actual working conditions determined upon without opening the entire door, which would alter the proportions of air and steam.

The valve in the supply-pipe controls the quantity of steam to be used for superheating in the retort, the pressure-gage indicating the quantity and the thermometer showing the temperature of the steam, and when it is desired to see the temperature of the superheated steam by turning on the petcock in the fitting at the free end of the retort a vent for the escape of the superheated steam is made and its temperature is shown on the thermometer placed in the path of the escaping steam. The retort being mounted in a manner which permits of its being revolved for adjustment and the swivel-union connections permitting such revoluble adjustment to give direction to the steam-jets of superheated steam issuing from the retort, it is only necessary to put a wrench or tongs on the pipe and fitting and adjust the retort as desired.

The retort being placed where it is subjected to the intense heat of the furnace the steam which enters it is heated to a high degree by contact, and as it is immediately discharged through the openings 29 this temperature is not reduced, as in other systems; but, on the contrary, it is further increased in temperature in its passage toward the incandescent fuel, so that a fixed hydrogen gas is formed. We find in practice that by the introduction of a quantity of superheated steam at a point near the entrance of the air-oxygen the quantity of the latter may be considerably reduced, the hydrogen raising the temperature of the fire-chamber, which in turn raises the temperature of the retort and the steam passing through it. The hydrogen combining with the oxygen gives intense heat and sets the carbon in the fuel free, which, passing from the hydrogen to the oxygen, gives heat without smoke.

We do not herein broadly claim the superheating-retort, that being the subject of another application, Serial No. 45,876; but the construction of the door and the operative combination of the door with our improved revoluble superheating-retort we believe to be new.

What we claim as new, and desire to secure by Letters Patent, is—

1. In a furnace-door as described, the combination of a semicylindrical casing consisting of a stationary outer casing and an adjustable inner casing, a deflecting-plate secured to and operating with said inner casing, of a perforated shield and means between the periphery of the said inner and outer casings for holding the said adjustable inner casing in a fixed position, substantially as described.

2. A furnace-door consisting of a foraminous frame, a cylindrical casing formed of a stationary outer part and an adjustable inner part, pivotally connected together, of a perforated vertical shield within said semicylindrical casing, said shield being provided with a transparent shield, and of an opening in said outer casing on a horizontal line with said transparent shield for the purpose specified and substantially as shown.

3. In combination a furnace-door as described, a foraminous frame, a semicylindrical casing consisting of an outer and inner casing pivotally connected and operating one within the other, a perforated shield provided with a perforated piece of mica and of an opening in said outer casing on a horizontal line with said perforated mica, for the purpose of forming a means of observation, substantially as described.

4. In a furnace-door as described, a curved inner adjustable door pivotally connected within an outer stationary curved part, means for holding the said inner door open for the admission of air, which means consist of a ratchet fastened on the periphery of the inner door and of a ball pivotally attached to the outer casing, substantially as described.

5. In a furnace-door, the combination of a foraminous frame of angle-iron, an outer semicylindrical casing consisting of an outer stationary curved part riveted to said frame, semicircular plates 12 13 riveted to said frame and to the outer semicylindrical casing 11, of an adjustable inner casing 15, pivotally supported within the outer casing, a curved plate 22, attached to said inner casing, a gridiron-damper and an observation-opening in the said outer casing, of a perforated shield 18, having a transparent shield 19 all combined, substantially in the manner and for the purpose set forth and described.

6. In an attachment for preventing smoke in furnaces, the combination with a furnace, of a door comprising a semicylindrical casing consisting of a stationary outer casing and an adjustable inner casing, a deflecting-plate secured to and operating with said inner casing, a perforated shield and means between the periphery of the said inner and outer casings for holding the said adjustable inner casing in a fixed position, and means for introducing steam in such a manner as to coact or mingle with the air fed through the door, substantially as described.

Signed at New York, in the county of New York and State of New York, this 10th day of December, A. D. 1900.

EDDY H. HOVEY.  
ELLIOTT P. GLEASON.

Witnesses:

ELLIOTT G. ALBEE,  
OLIN F. GLEASON.

It is hereby certified that in Letters Patent No. 688,417, granted December 10, 1901, upon the application of Eddy H. Hovey and Elliott P. Gleason, of Brooklyn, New York, for an improvement in "Fuel-Economizers," an error appears in the printed specification requiring correction, as follows: In line 91, page 3, the word "ball" should read *pawl*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 24th day of December, A. D., 1901.

[SEAL.]

F. L. CAMPBELL,  
*Assistant Secretary of the Interior.*

Countersigned:

F. I. ALLEN,  
*Commissioner of Patents.*