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PATENTED FEB. 12, 1907.

K. SCHLEYDER.

SMOKE CONSUMER FOR LOCOMOTIVE AND LIKE BOILERS.

APPLICATION FILED MAY 28, 1906.

2 SHEETS—SHEET 1.

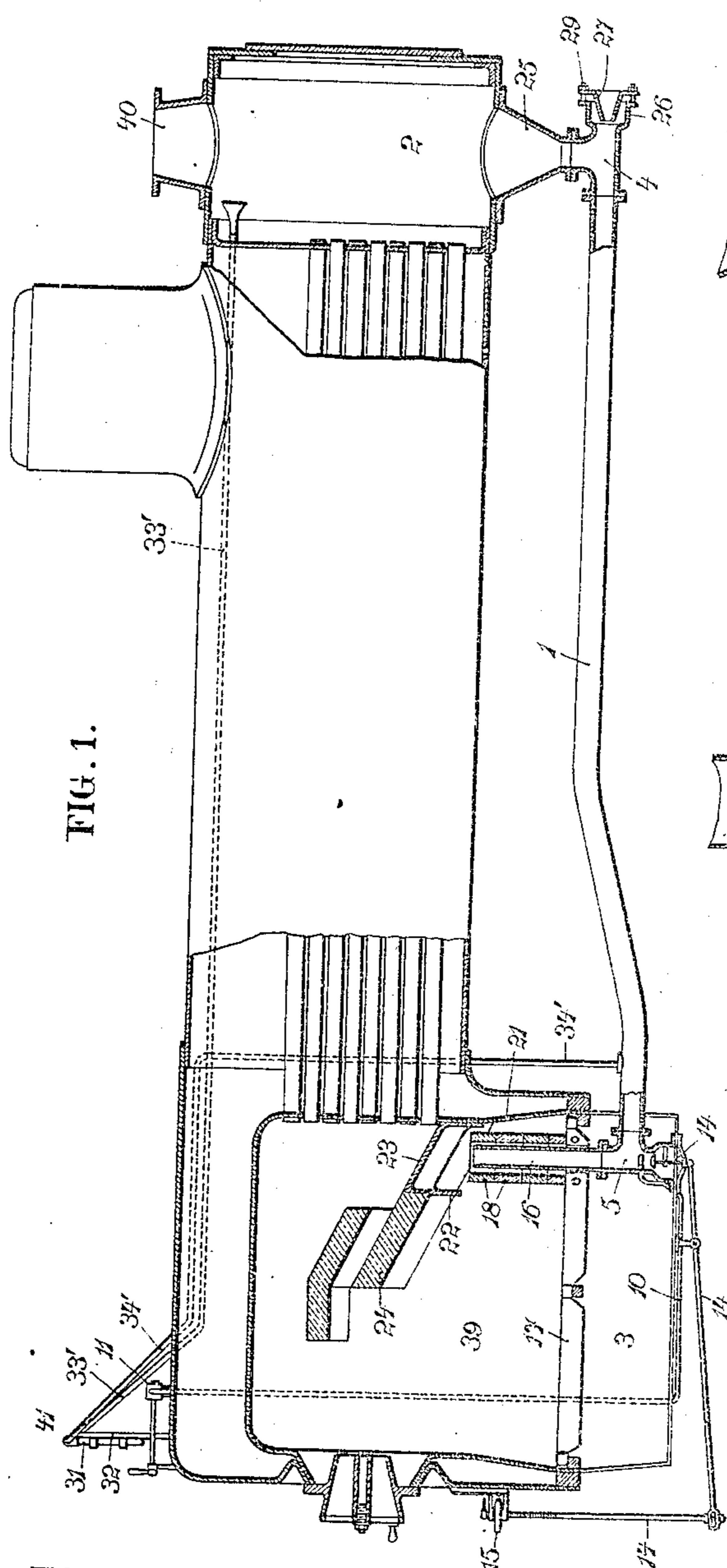


FIG. 1.

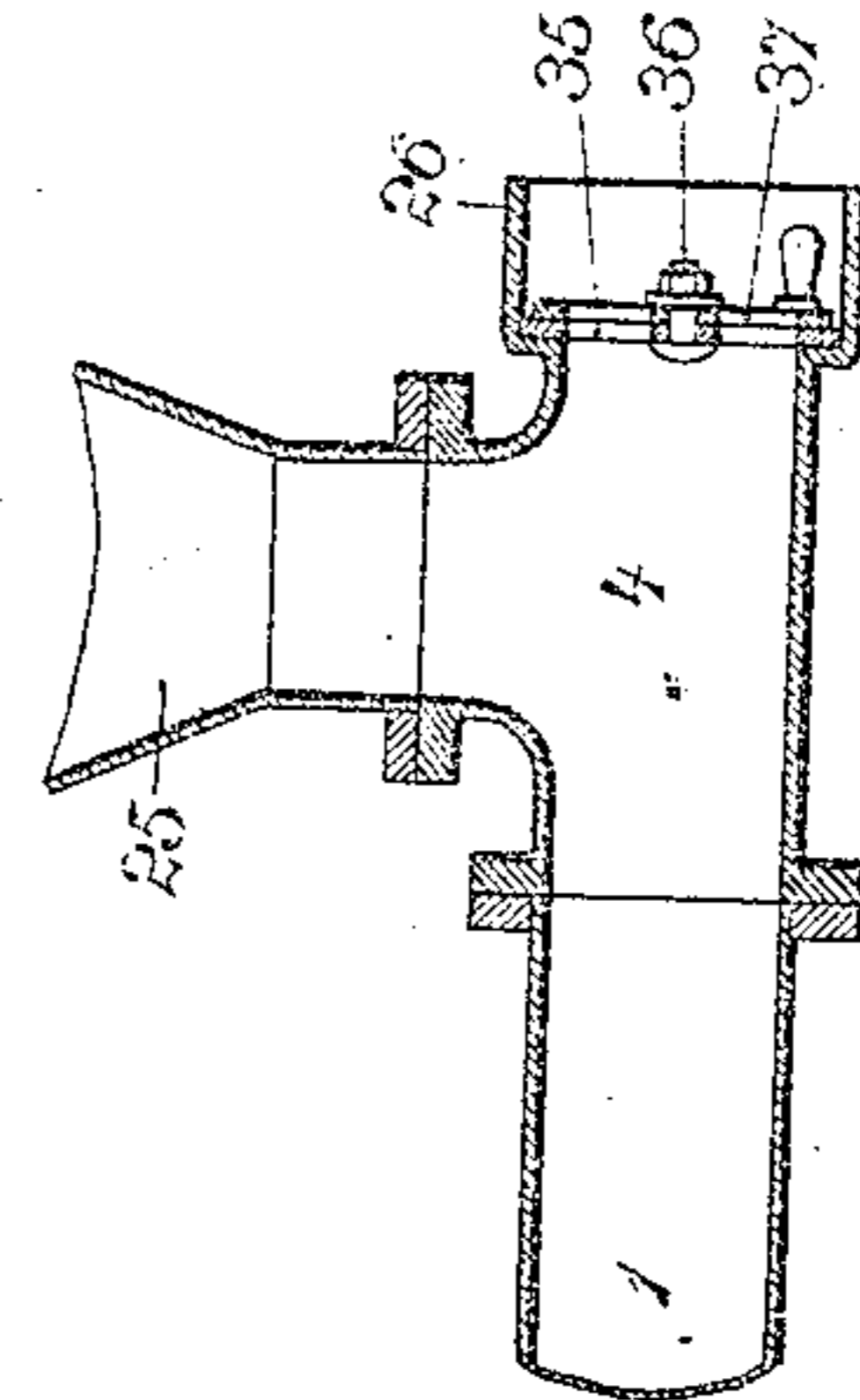


FIG. 9.

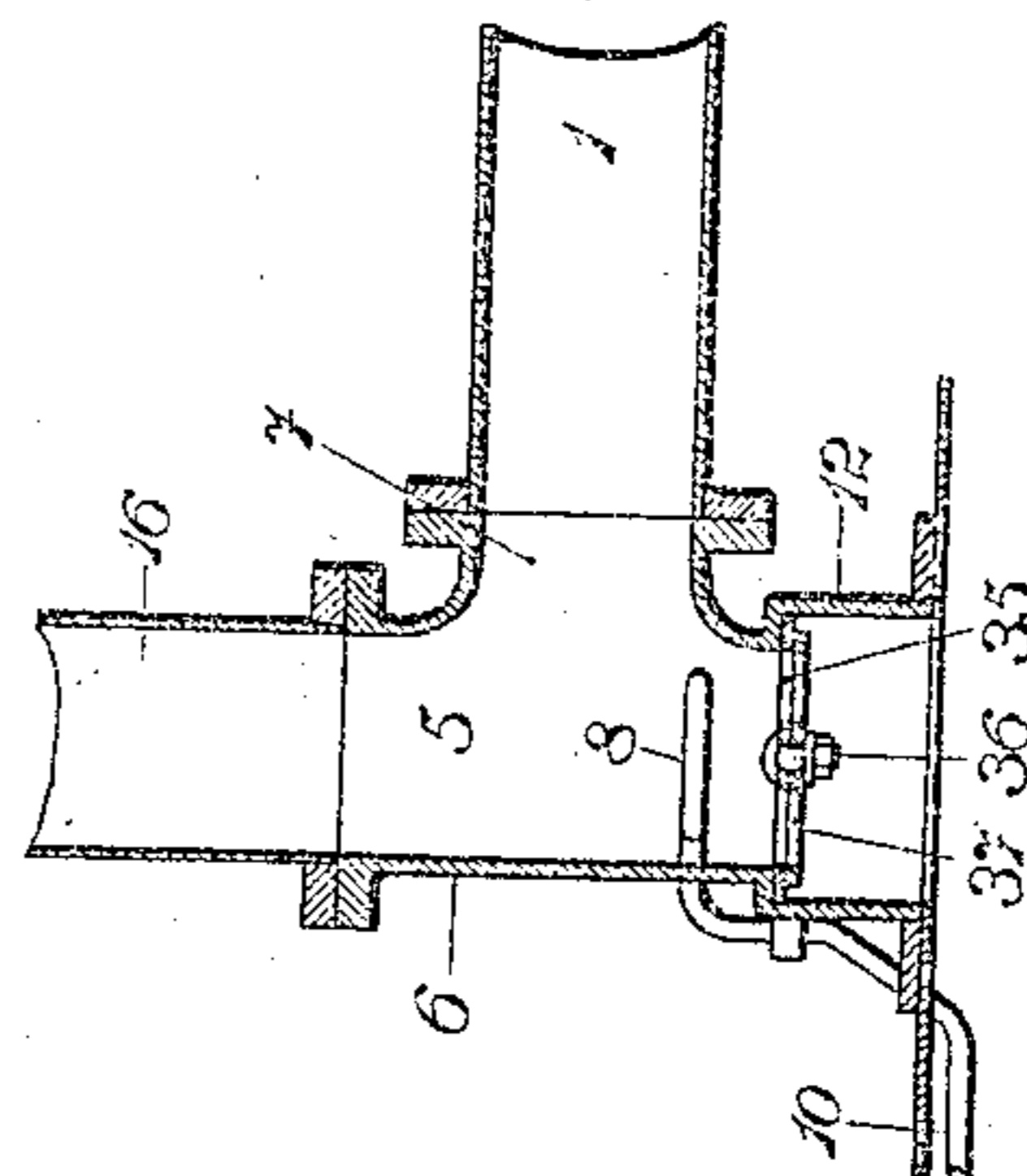


FIG. 7.

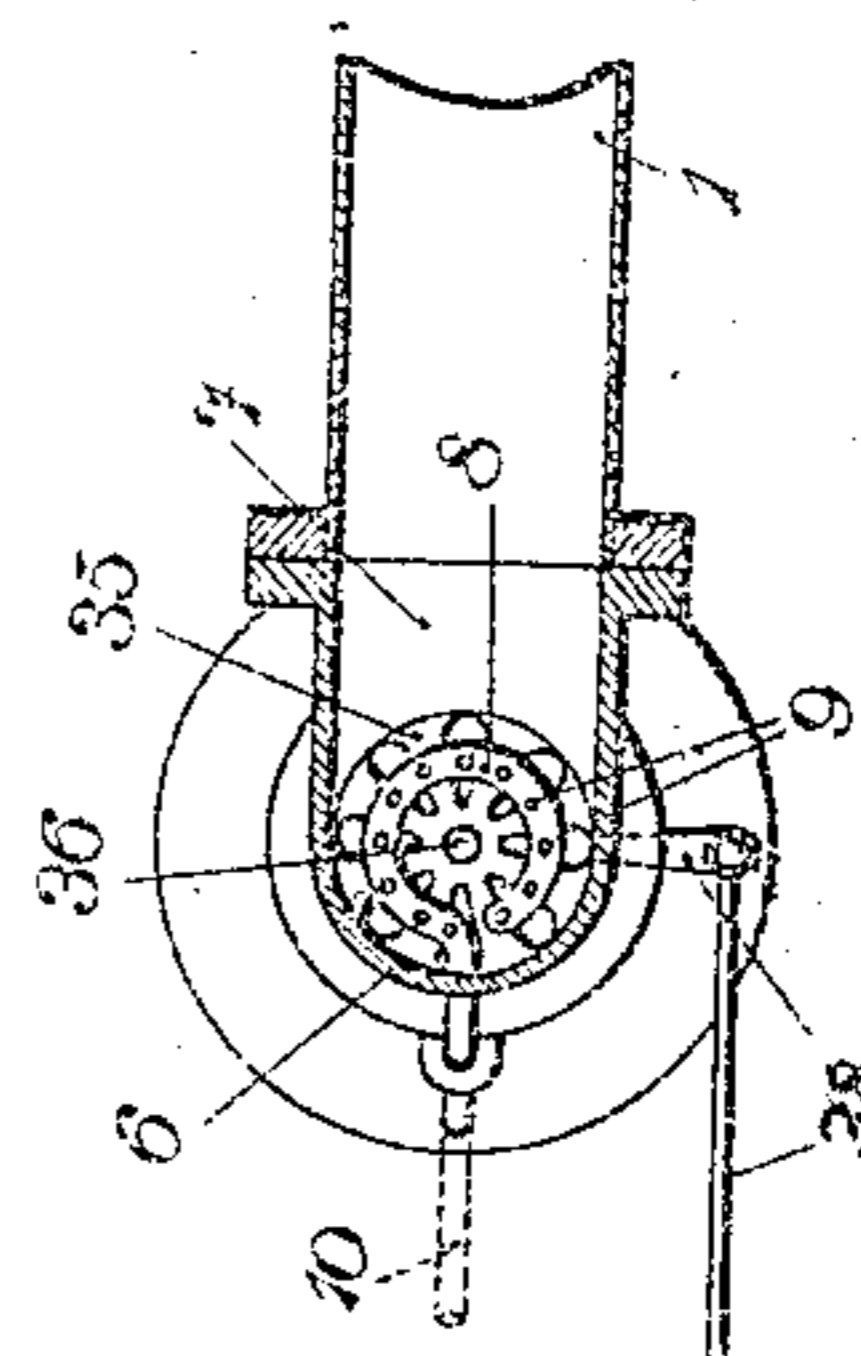


FIG. 8.

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No. 843,848.

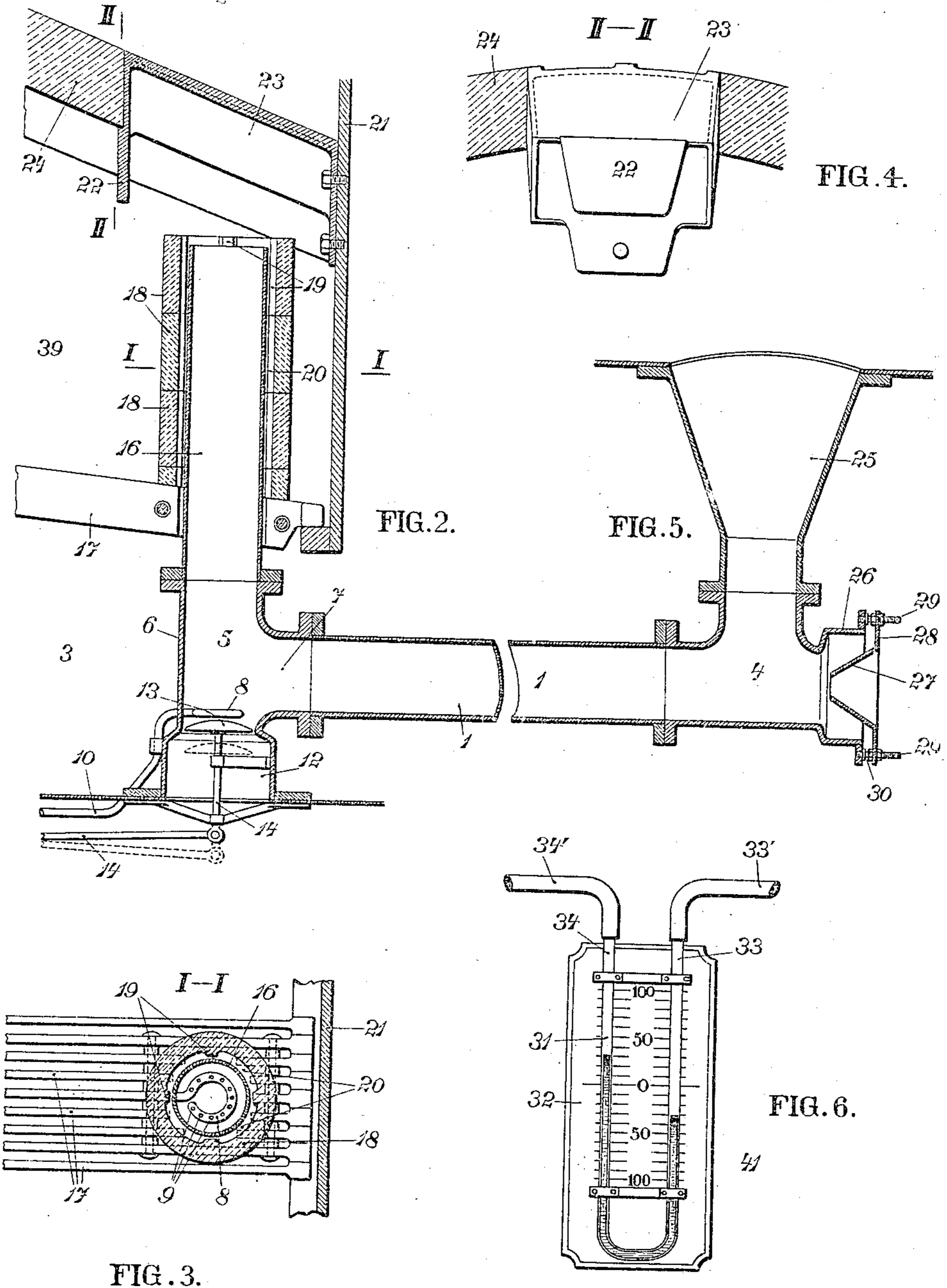
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2 SHEETS—SHEET 2.



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# UNITED STATES PATENT OFFICE.

KARL SCHLEYDER, OF RAKONITZ, AUSTRIA-HUNGARY.

## SMOKE-CONSUMER FOR LOCOMOTIVE AND LIKE BOILERS.

No. 843,848.

Specification of Letters Patent.

Patented Feb. 12, 1907.

Application filed May 28, 1906. Serial No 319,093.

*To all whom it may concern:*

Be it known that I, KARL SCHLEYDER, a subject of the King of Bohemia, and residing at Rakonitz, Bohemia, Austrian Empire, have invented certain new and useful Improvements in Smoke-Consumers for Locomotive and Like Boilers, of which the following is a specification.

The subject of the present invention is an improved smoke-consuming apparatus for locomotive-engine and other boilers.

By means of this invention the products of combustion which escape into the smoke-box without being thoroughly utilized are sucked into the fire-box again for recombustion in such manner that the development of flame in the fire-box is not only not arrested, but, on the contrary, is actively assisted and the generation of steam accelerated and increased, while coal is economized and smoke avoided.

The improvement consists in the products of combustion which are conducted from the smoke-box into the fire-box through the well-known suction-pipe being mixed with a suitable quantity of air by special means and in the intensity of the suction of these products of combustion and of the air being controlled and regulated corresponding to the chimney-draft.

The improved smoke-consumer is illustrated in the accompanying drawings, in which it is shown applied, by way of example, to a locomotive-boiler.

Figure 1 is a vertical section of a locomotive-boiler fitted with the new apparatus. Fig. 2 is a vertical section showing certain details of Fig. 1, drawn to a larger scale. Fig. 3 is a horizontal section on the line II of Fig. 2. Fig. 4 is a vertical section on line III of Fig. 2. Fig. 5 is a vertical section showing further details of Fig. 1, drawn to a larger scale. Fig. 6 is an elevation of the differential draft-meter employed; drawn to an enlarged scale. Figs. 7-9 are detail views illustrating modifications of the apparatus.

The suction-pipe 1, which connects the smoke-box 2 with the ash-pan 3, is secured at one end to an air-inlet casing 4, located below the smoke-box, and at the other end to a smoke and air ejector 5; located in the ash-pan.

The ejector, Figs. 1 and 2, consists of a vertical cast-iron casing 6, having flanges below and above and having also a lateral flange 7 to connect the pipe 1. Within the casing 6

there is located an annular perforated pipe 8, to which a pipe 10, controlled by a valve 11, conducts dry steam from the boiler. The steam passes upward through the perforations 9 and assists the suction action of the ejector. The casing 6 is widened below, and in this enlarged part 12 a flat cone 13 is provided, the height of which can be adjusted from the foot-plate by means of a system of rods 14 and hand-wheel 15, whereby the entrance of air into the ejector can be regulated.

At the top of the casing 6 there is connected a pipe 16, which projects through the grate 17 into the fire-box 39. This pipe 16 is surrounded by a stack of rings 18, which present ribs 19 on the inside, so that passages 20 are formed between the pipe 16 and the rings 18. Through these passages 20 fresh air flows into the fire-box 39, and the rings 18 and the pipe 16 are cooled, whereby they are better able to resist the action of the flames. When the part of the rings which lies next to the flames is worn out, the rings can be turned in order that the other not yet worn parts lying next to the tube-plate may be exposed to the direct action of the flames.

Above the pipe 16 there is located a box 23, of some refractory material, such as toughened cast-iron, having a depending screen or plate 22. This box 23 is secured in inverted position—that is, with the open side downward—to the tube-plate 21 and is bricked into the fire-box arch 24. The screen 22 extends downward as far as the mouth of the pipe 16, and thus prevents the entry of coal into this pipe on the fire being stoked.

At the place where the funnel 25 of the smoke-box 2 is connected with the pipe 1 the air-inlet casing 4, Figs. 1 and 5, is provided. This casing is shaped similarly to the casing 6 of the ejector, but is horizontally located and is connected, by means of flanges, with the funnel 25 and with the pipe 1. The front part 26 of the casing is enlarged, and at such part there is located a hollow truncated cone 27, provided with an annular plate 28. The latter is adjustably secured to the casing 4 by means of bolts 29, so that the air-supply through the gap 30 can be regulated.

By the exit of steam from the annular pipe or "steamer" 8 the ejector 5, and thus the entire smoke-consuming apparatus, is set in operation, for owing to the action of the steamer 8 in the ejector 5 the pipe 1, casing 4,

and funnel 25 will cause a strong draft in the direction of the fire-box, stronger than in the chimney 40 itself, so that the products of combustion which enter the smoke-box and which otherwise would escape through the chimney into the air are compelled to flow back through the funnel 25, pipe 1, and ejector 5 into the fire-box again. In order, however, to cause combustion of these returned products in the fire-box 39 not only without obstructing the ordinary combustion process in the latter, but so as to promote the same, it is necessary to mingle the said returned products of combustion with an ample supply of fresh air and to maintain the draft in the pipe 1 in a definite relation to the draft in the chimney or in the upper part of the smoke-box. It is thus necessary always to know exactly the difference between the draft in the funnel 25 or pipe 1 and that in the top part of the smoke-box (above the top row of boiler-pipes) or in the chimney, since otherwise in the event of only slight suction there would be practically no return of the products of combustion, while in the case of an unduly strong draft there would be a serious waste of steam, and owing to the strong inrush into the fire-box the fire would be choked. For this purpose a differential draft-meter 41 is employed, one form of the apparatus being shown in Fig. 6. It is mounted on some part where it can be readily seen by the engineer and consists of a U-shaped glass tube 31, secured to a plate 32, provided with a scale. The one limb 33 of the tube 31 is connected by the tube 33' with the smoke-chamber above the top row of boiler-pipes or with the chimney, while the other limb 34 is connected by the tube 34' with the pipe 1 or funnel 25. The U-tube is partly filled with a suitable liquid, so that the reading is zero in both limbs when the boiler is not heated. When the boiler is fired up and the smoke-consumer operates, the liquid in the U-tube changes its position. The more intense the suction through the ejector 5 the higher the liquid will rise in the limb 34, which communicates with the pipe 1. The difference, for example, when the locomotive is standing and the starting-valve wholly open is eighty to one hundred millimeters. When the locomotive is running, the difference decreases, owing to the draft in the chimney, to thirty to fifty millimeters. It is thus necessary to determine this difference experimentally and mark it on the scale for different locomotives and differently-forced fires or for different kinds of coal. By means of this differential draft-meter 41, therefore, the draft can be accurately determined at any moment, and by actuating the valve 11 and the air-inlet devices in the ejector and the casing both the quantity of the products of combustion sucked up and the amount of fresh air drawn in can be regulated.

The toughened cast-iron box 23, which is built into the lower fire-box arch 24, is for the purpose of protecting the pipe 16 of the ejector by means of the screen 22 and of causing the products of combustion which are blown into the box 23 to be partly consumed by the glowing walls of the same and partly deflected downwardly toward the grate, where they mingle with the other furnace-gases.

In Figs. 7-9 another form of construction of the regulating device for the smoke and air ejector 5 and the air-inlet casing 4 is shown. According to this modification the enlargements 12 and 26 are each provided with a perforated plate 35 and a damper 37, furnished with corresponding perforations and rotating about the central bolt 36. In this manner the holes in the plate 35 can be opened more or less, as required. The rotary damper 37 in the ejector 5 is actuated by a rod 38 and auxiliary mechanism from the foot-plate of the engine.

The herein-described smoke-consuming apparatus can be employed not only for the boilers of locomotives, but also for those of ships and likewise for stationary boilers.

What I do claim, and desire to secure by Letters Patent, is—

1. In a steam-boiler, in combination, a furnace, a smoke-chamber, a smoke and air ejector located in the furnace, a pipe connecting the bottom of the smoke-chamber with the ejector, means for regulating the air-supply to the ejector and to the said connecting-pipe, and a differential liquid draft-meter, the one side of which is exposed to the action of the main current from the furnace, while the other side is exposed to the return-current from the smoke-chamber, substantially as set forth.

2. In a steam-boiler, in combination, a furnace having an ash-pan, a grate, a smoke-chamber, a smoke and air ejector comprising a vertical pipe open at both ends and projecting from the ash-pan, through the grate into the furnace-chamber, superposed internally-ribbed rings surrounding the said vertical pipe, means for regulating the air-inlet to the pipe, and a perforated device for admitting steam into the said pipe, a pipe connecting the bottom of the smoke-chamber with the ejector, means for regulating the air-supply to the said connecting-pipe, and a differential liquid draft-meter, the one side of which is exposed to the action of the main current from the furnace, while the other side is exposed to the return-current from the smoke-chamber, substantially as set forth.

3. In a steam-boiler, in combination, a furnace, an ash pan therein, a grate, a smoke-chamber, a smoke and air ejector comprising a vertical pipe open at either end and projecting from said ash-pan, through the grate into the furnace-chamber, superposed internally-ribbed rings surrounding the said vertical

pipe, means for regulating the air-inlet to the pipe, and a perforated device for admitting steam into the said pipe, a pipe connecting the bottom of the smoke-chamber with the  
5 ejector, means for regulating the air-supply to the said connecting-pipe, consisting of a truncated, flanged hollow cone, adjustably secured at the mouth of the pipe which is widened for its reception, and a differential  
10 liquid draft-meter one side of which is exposed to the action of the main current from the furnace and the other side to the return-current from the smoke-chamber, substantially as set forth.

15 4. In a steam-boiler, in combination, a furnace, an ash-pan therein, a grate, a smoke-chamber, a smoke and air ejector comprising a vertical pipe open at both ends and projecting from the said ash-pan, through the grate  
20 into the furnace-chamber, superposed internally-ribbed rings surrounding the said ver-

tical pipe, means for regulating the air-inlet to the pipe, and a perforated device for admitting steam into the said pipe, a refractory  
inverted box located at the furnace-arch, and 25 presenting a dependent screen protecting the top of the said vertical ejector-pipe, a pipe connecting the bottom of the smoke-chamber with the ejector, means for regulating the air-supply to the said connecting-pipe, and a  
30 differential liquid draft-meter, one side of which is exposed to the action of the main current from the furnace and the other side to the return-current from the smoke-chamber, all substantially as and for the purpose 35 set forth.

In testimony whereof I affix my signature in presence of two witnesses.

KARL SCHLEYDER.

Witnesses:

MILOSLAV F. CRUBY,  
ADOLPH FISCHER.