No. 891,231.

PATENTED JUNE 23, 1908.

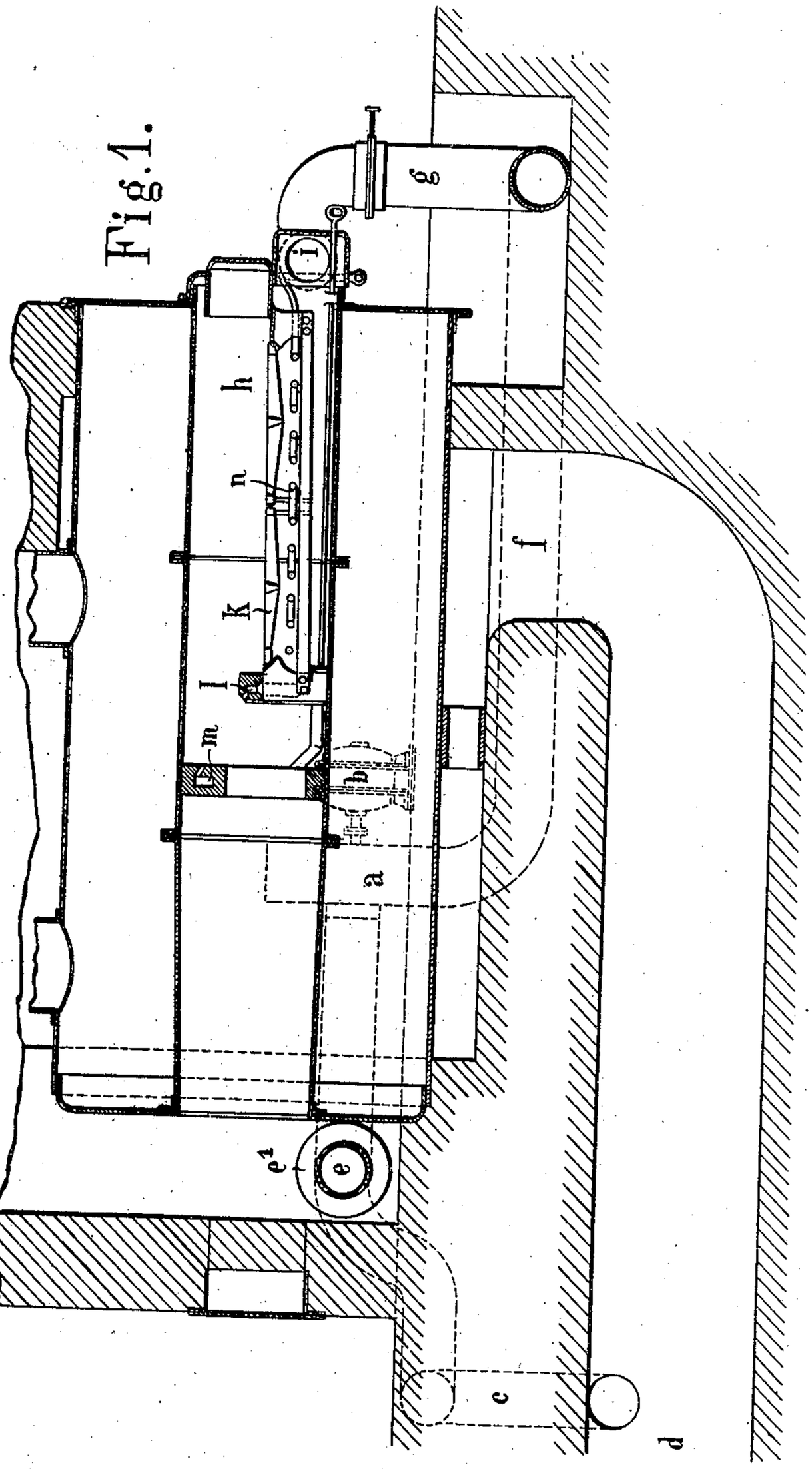
W. CASSENS.

BOILER FURNACE.

APPLICATION FILED FEB. 28, 1905.

5 SHEETS—SHEET 1.

Fig. 1.



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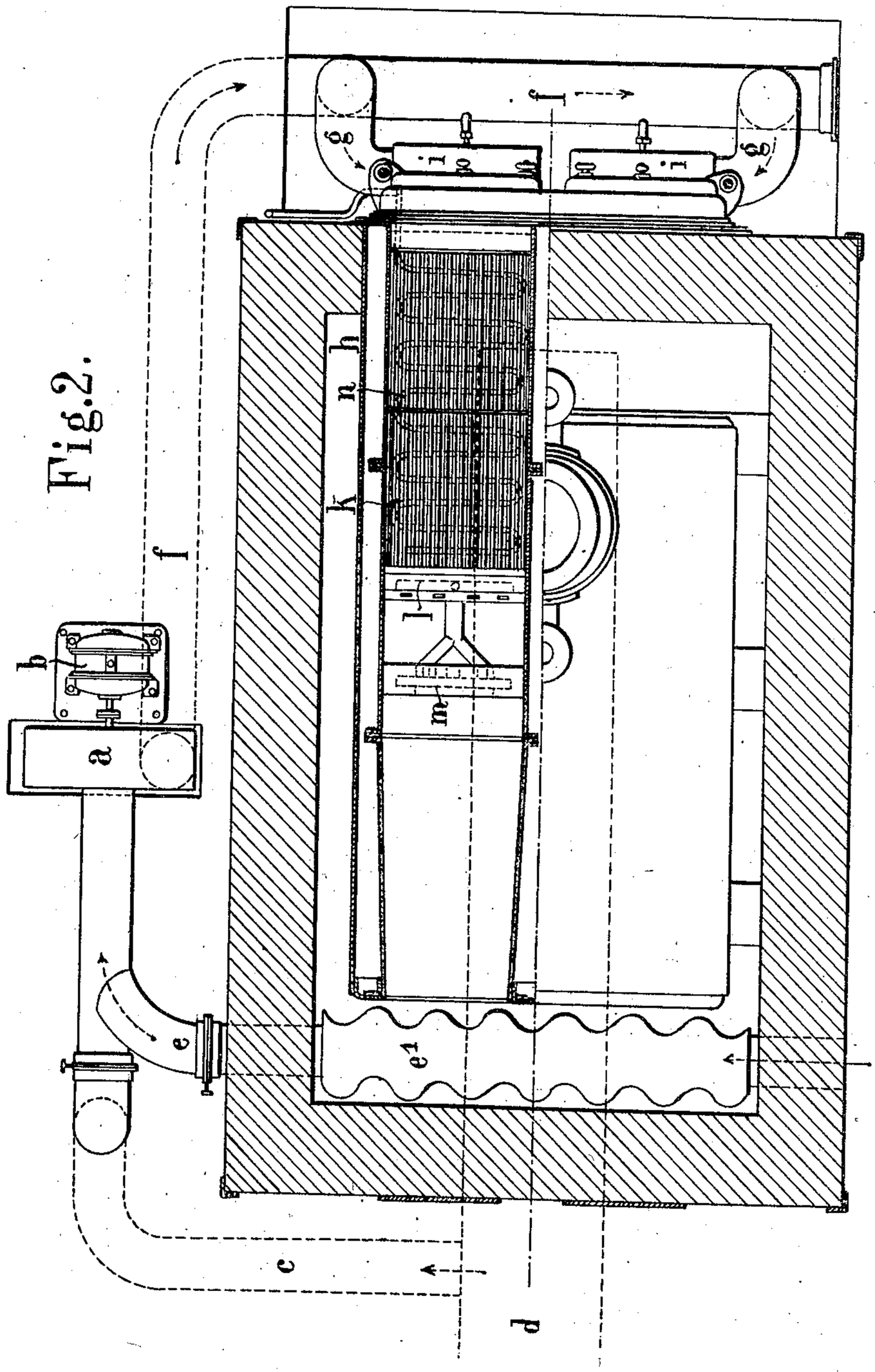
5 SHEETS—SHEET 2.

Fig.2.



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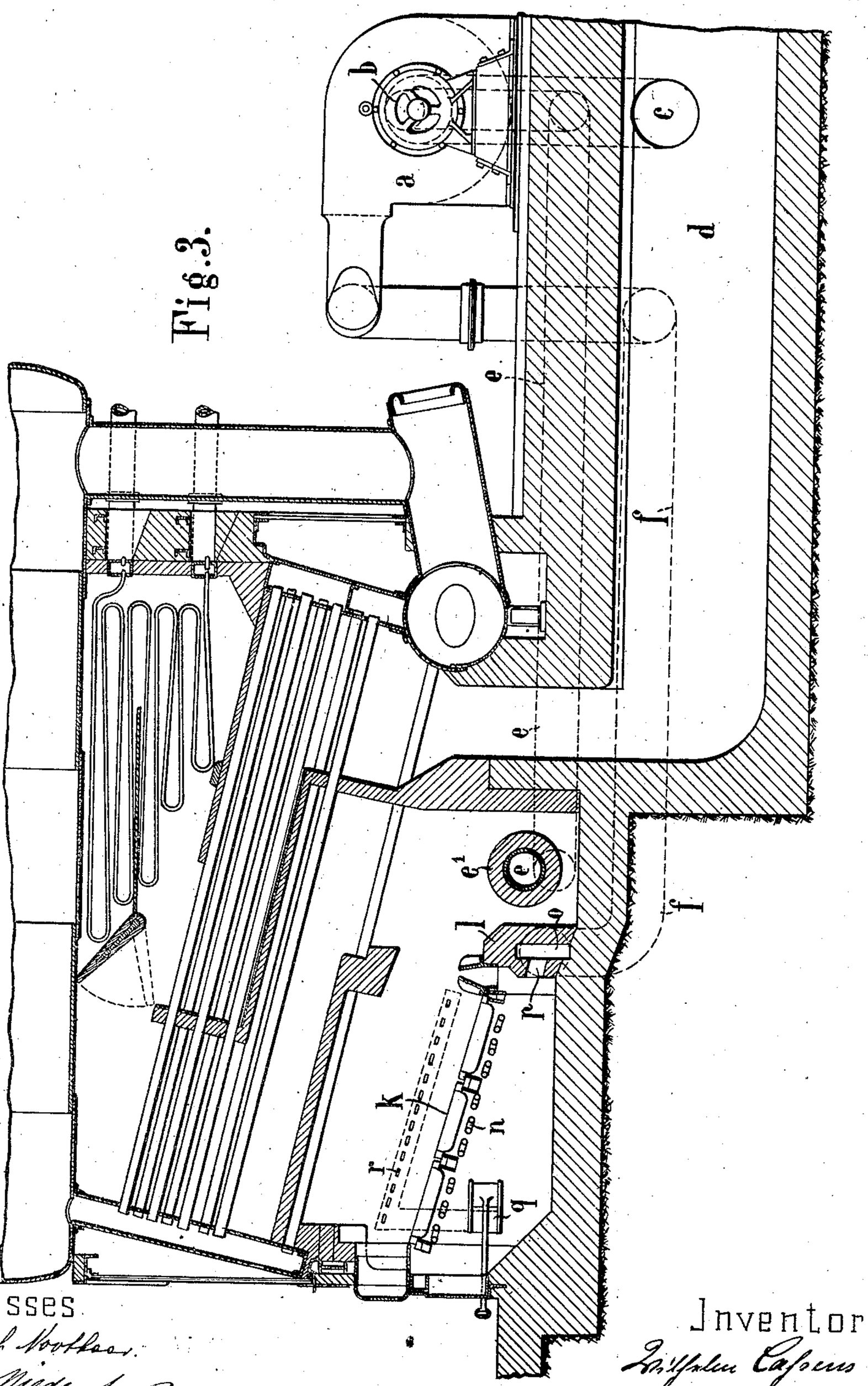
5 SHEETS—SHEET 3.

Fig. 3.



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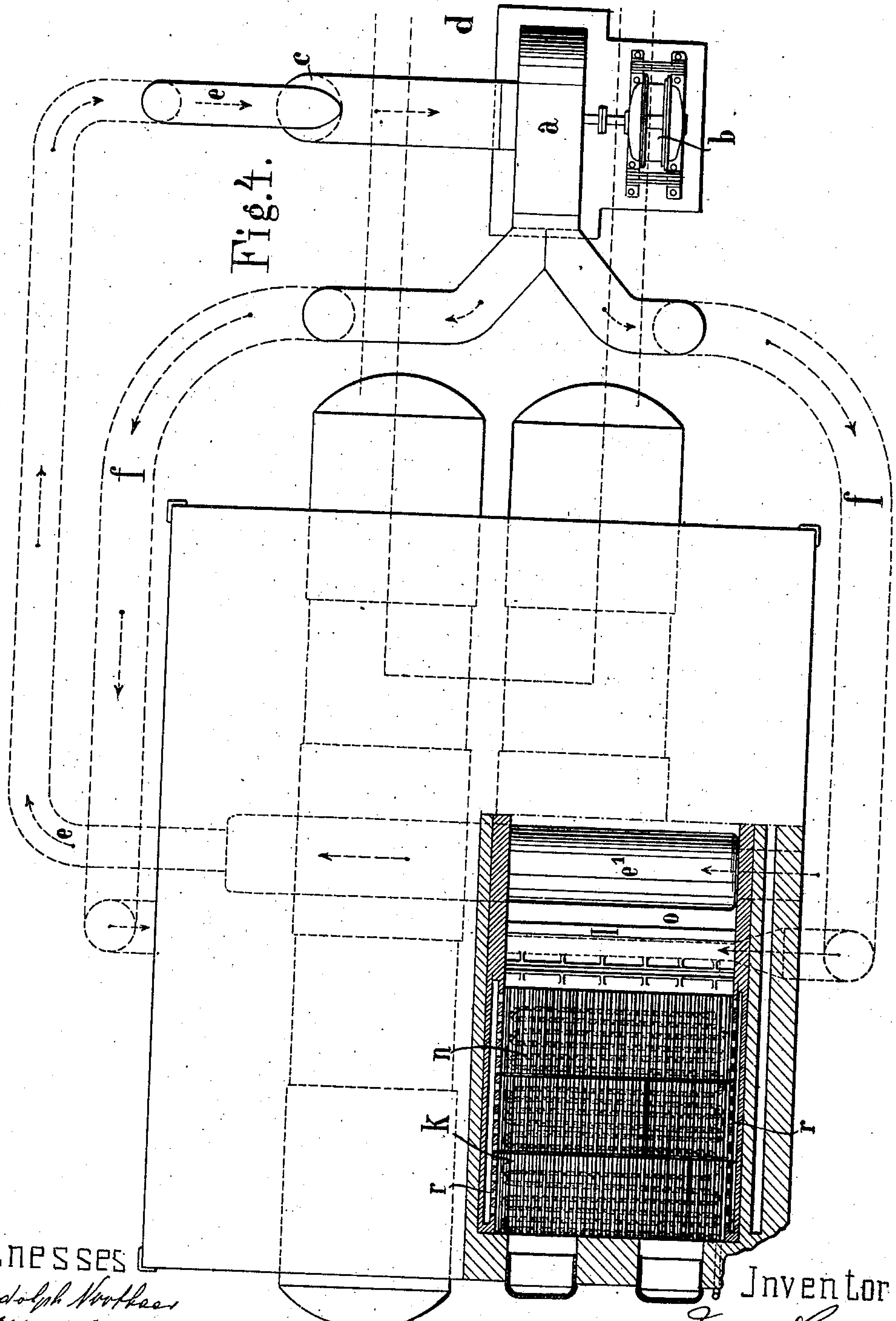

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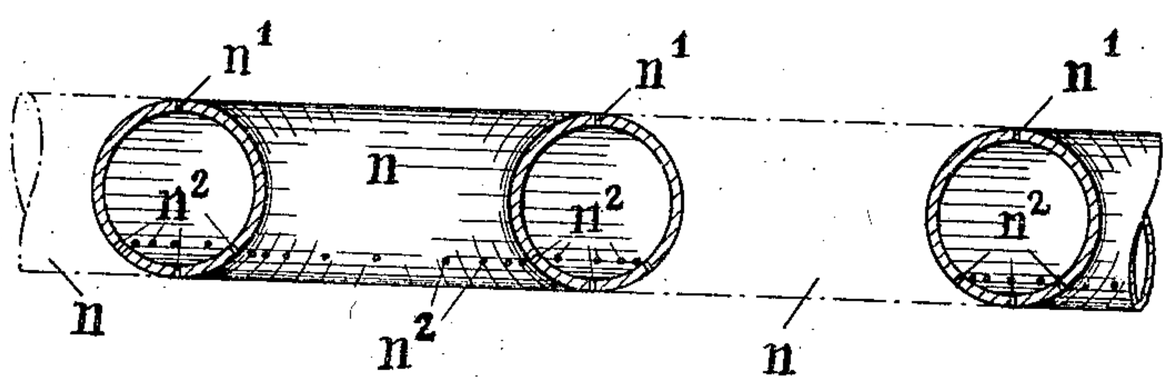
APPLICATION FILED FEB. 28, 1905.

5 SHEETS—SHEET 5.

Fig. 5.



Witnesses:
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Inventor:
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UNITED STATES PATENT OFFICE.

WILHELM CASSENS, OF BERLIN, GERMANY.

BOILER-FURNACE.

No. 891,231. Specification of Letters Patent. Patented June 23, 1908.

Application filed February 28, 1905. Serial No. 247,809.

To all whom it may concern:

Be it known that I, WILHELM CASSENS, engineer, a subject of the Grand Duke of Oldenburg and German Emperor, residing at Berlin, in the Kingdom of Prussia and German Empire, have invented certain new and useful Improvements in Boiler-Furnaces, of which the following is a specification.

My invention relates to an improvement in boiler furnaces in which smoking shall be prevented by reutilizing part of the waste gases in such a manner that the gases to be reutilized are mixed with fresh air and steam from a suitable steam source and are forced beneath the grate, whence this mixture of waste gases, fresh air and steam pass to the glowing fuel above the grate, where the combustion of the mixture is effected.

The invention consists in certain novel constructions, combinations and arrangements of the parts as will be hereinafter described and pointed out in the claims.

In the drawings Figure 1 is a vertical section and Fig. 2 is a sectional plan of Lancashire boiler with the apparatus for conducting the combustion in the manner above indicated. Figs. 3 and 4 show a water-tube boiler likewise in vertical section and sectional plan, embodying my improvements. Fig. 5 shows in an enlarged scale part of the perforated tubing arranged below the grate.

That portion of the furnace gases intended to be re-utilized is led through the pipe *c* (Figs. 1 and 2) from the flue or passage *d* by means of a fan *a*, in the present case driven by an electro-motor *b* which draws atmospheric air through the pipes *e*, *e'*. The pipe *e'* lies across the path of the hot gases at the back of the boiler so that said gases circulating about the same strongly heat the air passing through said pipe. The inflowing air and the furnace gases are thoroughly mingled in the fan *a* and are forced through the pipe *f* into the box-like chambers *i* in front of the boiler flues whence the hot mixture of air and waste gases passes under the grate.

Each ash box contains a system of tubing extending throughout below the grate-surface which in the present case is shown as a serpentine coil *n* and said tubing is preferably all round, but at least at top and bottom provided with a large number of orifices n^1 n^2 (Fig. 5) and said coil is connected with a suitable source of steam supply, for instance with the steam space in the interior of the generator, so that the steam corresponding to the boiler pressure, will issue in fine jets through the bottom perforations into the hot mixture of air and furnace gases filling the ash-box. This mixture passes to the glowing fuel on the grate *k* only when it passes from the space beneath the coil into the space above the same. As however the jets from the pipe *n* are so directed that under the grate a mixture of air and steam is produced, the steam jets issuing upwardly through the upper perforations of the coil *n* comes in contact with the mixture of the ash-box on the glowing fuel, only a part of the steam of these upwardly directed jets being distributed among the mixture already formed so as to increase the moisture thereof, or to saturate the mixture, while the other part flows as pure steam along with the saturated mixture into the fire. There is immediately formed a sort of semi-water-gas or power-gas and not only the unconsumed constituents of the waste gases which have been brought through the pipe *c* undergo combustion, but also the combustion of the fuel on the grate is assisted. Hereby the formation of smoke is very considerably reduced and of such smoke a very considerable part is led back again beneath the grate, so that the chimney is practically as good as smokeless.

The production of smoke can be further lessened by leading the hot mixture of furnace gas, air and steam which is produced beneath the grate, over the fire, either at both sides or behind the grate.

In the construction shown in Figs. 1 and 2, behind the fire bridge *l* is a so-called gasification bridge *m* and both bridges are provided with nozzles or passages directed towards one another which are supplied from the ash-box, by means of suitable connections, with the hot mixture of air, steam and waste gases. Under the pressure of the fan, jets pass upwardly and at inclinations downwardly into the smoke or exhaust gases leaving the grate, the unconsumed constituents of which are in this way consumed so that only a minimum quantity of smoke passes into the flue *f*, of which a large proportion is drawn through the pipe *c* under the action of the fan and again passed to the furnace as above described.

In the construction shown in Figs. 3 and 4 the suction of the smoke from the flue and the conducting of the same back to the combustion chamber takes place in much the

same manner as that above described, only the mixture of air, steam and gas is led to a passage *o* in the firebridge whence it passes through openings *p* into the ash-box. In this modification the part of the hot mixture of furnace gases, steam and air which is led over the grate passes at both sides of the furnace up into the fire through orifices *r* fed from passages *q*. The operation in this case is the same as that described with reference to the preceding modification.

Having now described my invention what I claim and desire to secure by Letters Patent of the United States is:—

1. In combination with a boiler furnace provided with a grate, ash pit and an escape flue or passage, of a fan, a pipe communicating with the passage and the fan, an air heating pipe located in the gas passage, said pipe communicating with the pipe leading to the fan, a box-like chamber located in front of the ash pit of the furnace and in communication therewith, a pipe leading from the fan to said chamber, a system of perforated tubing arranged below the grate and means for supplying said tubing with steam substantially as set forth and for the purpose described.

2. In combination with a boiler furnace provided with a grate, ash pit and an escape flue or passage, of a fan, a pipe communicating with the passage and the fan, an air heating pipe located in the gas passage, said pipe communicating with the pipe leading to the fan, a box-like chamber located in front of the ash pit of the furnace and in communication therewith a pipe leading from the fan to said chamber a perforated serpentine-coil extending below the grate throughout the length of the ash pit, said coil being connected with the steam space in the interior of the generator substantially as set forth and for the purpose described.

3. In combination with a boiler furnace provided with a grate, an ash pit and an escape flue or passage, of a fan, a pipe communicating with the fan, a bridge wall having rearwardly directed nozzles, a second bridge spaced from the first and provided with forwardly directed nozzles, means connecting said nozzles with the ash pit an escape flue or passage and a fan, an air heating pipe located in the gas passage said pipe communicating with the pipe leading to the fan a box-like chamber located in front of the ash pit of the furnace and in communication therewith a pipe leading from the fan into said chamber a system of perforated tubing arranged below the grate and means for supplying said tubing with steam substantially as set forth and for the purpose described.

In testimony whereof I have hereunto set my hand in the presence of two witnesses.

WILHELM CASSENS

Witnesses:
RUROLPH VOOHIIAS,
GEO. NIEDEREBE.