

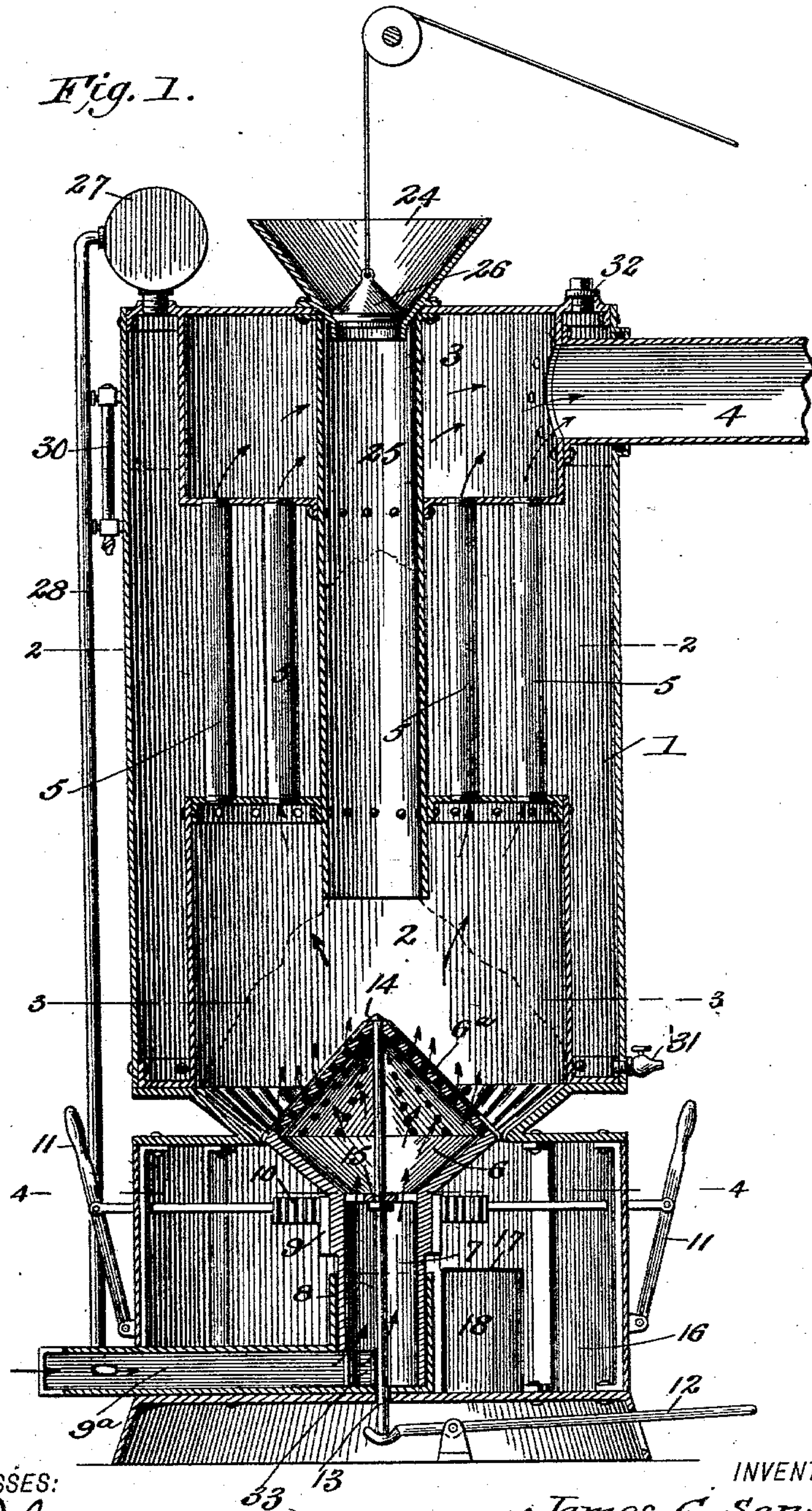
(No Model.)

3 Sheets—Sheet 1.

J. G. SANDERSON.  
FURNACE AND GRATE.

No. 561,729.

Patented June 9, 1896.



WITNESSES:

*W. S. Blouder.*  
*Geo. E. Turner.*

INVENTOR

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(No Model.)

3 Sheets—Sheet 2.

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Fig. 2.

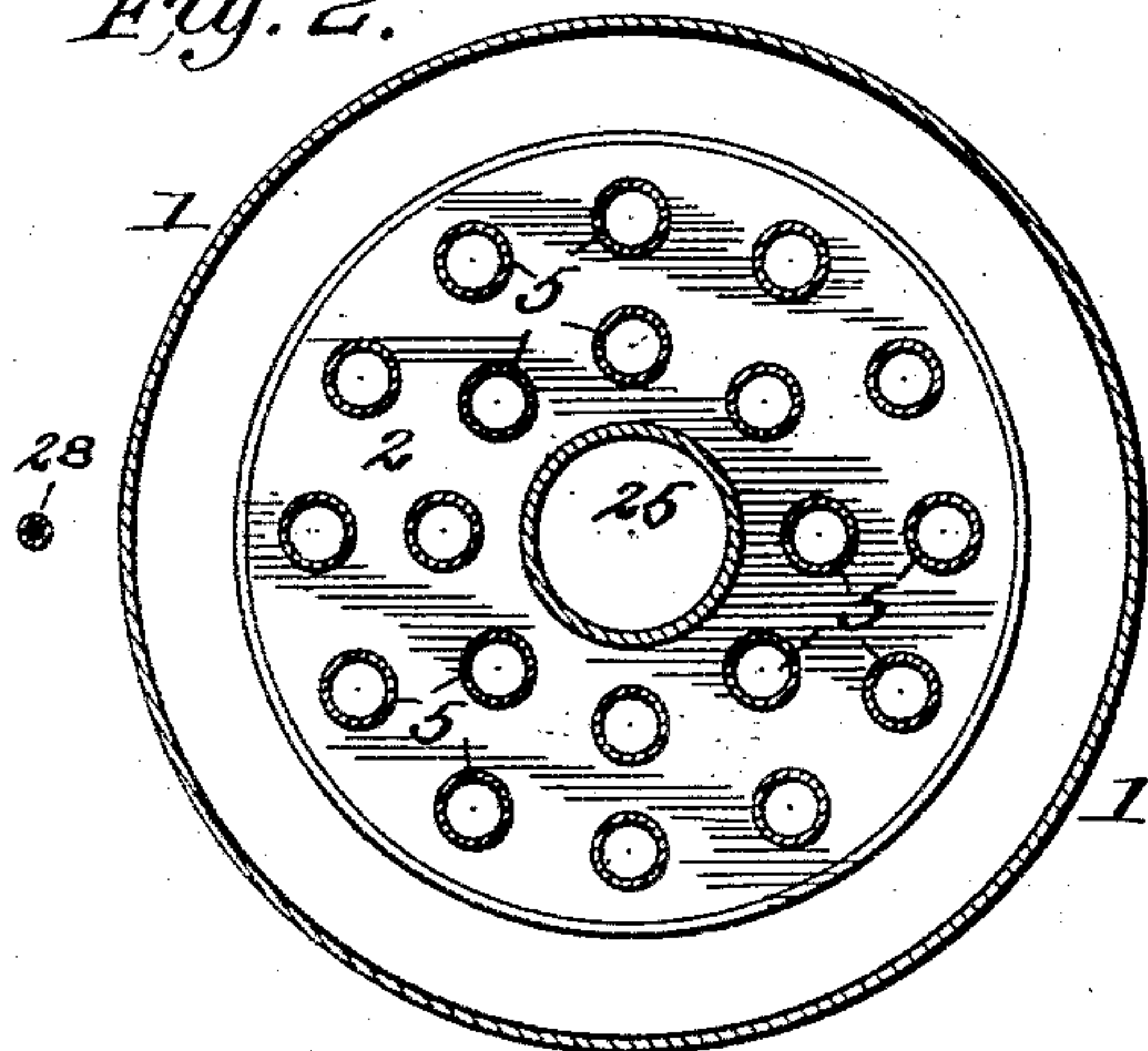


Fig. 3.

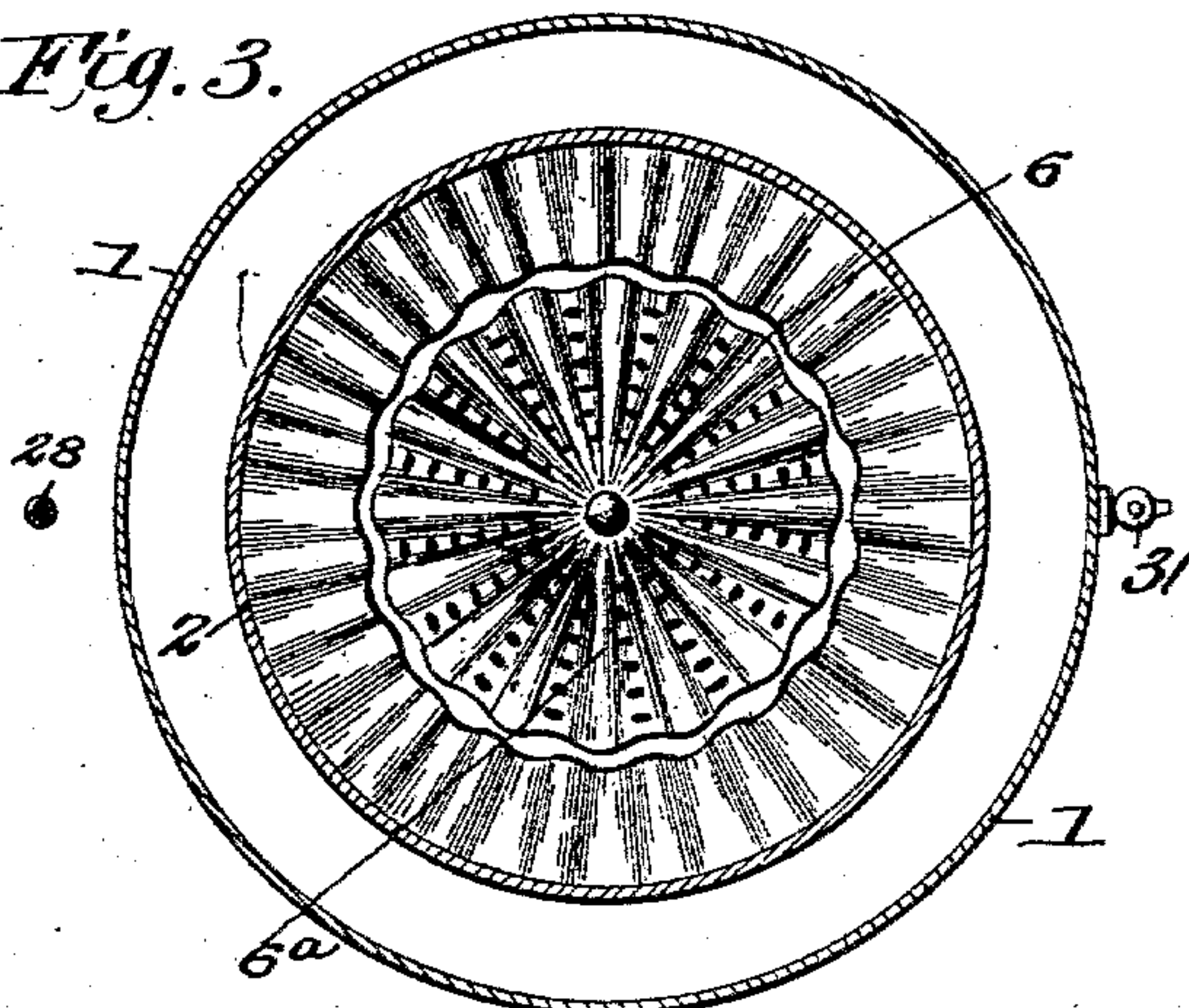


Fig. 4.

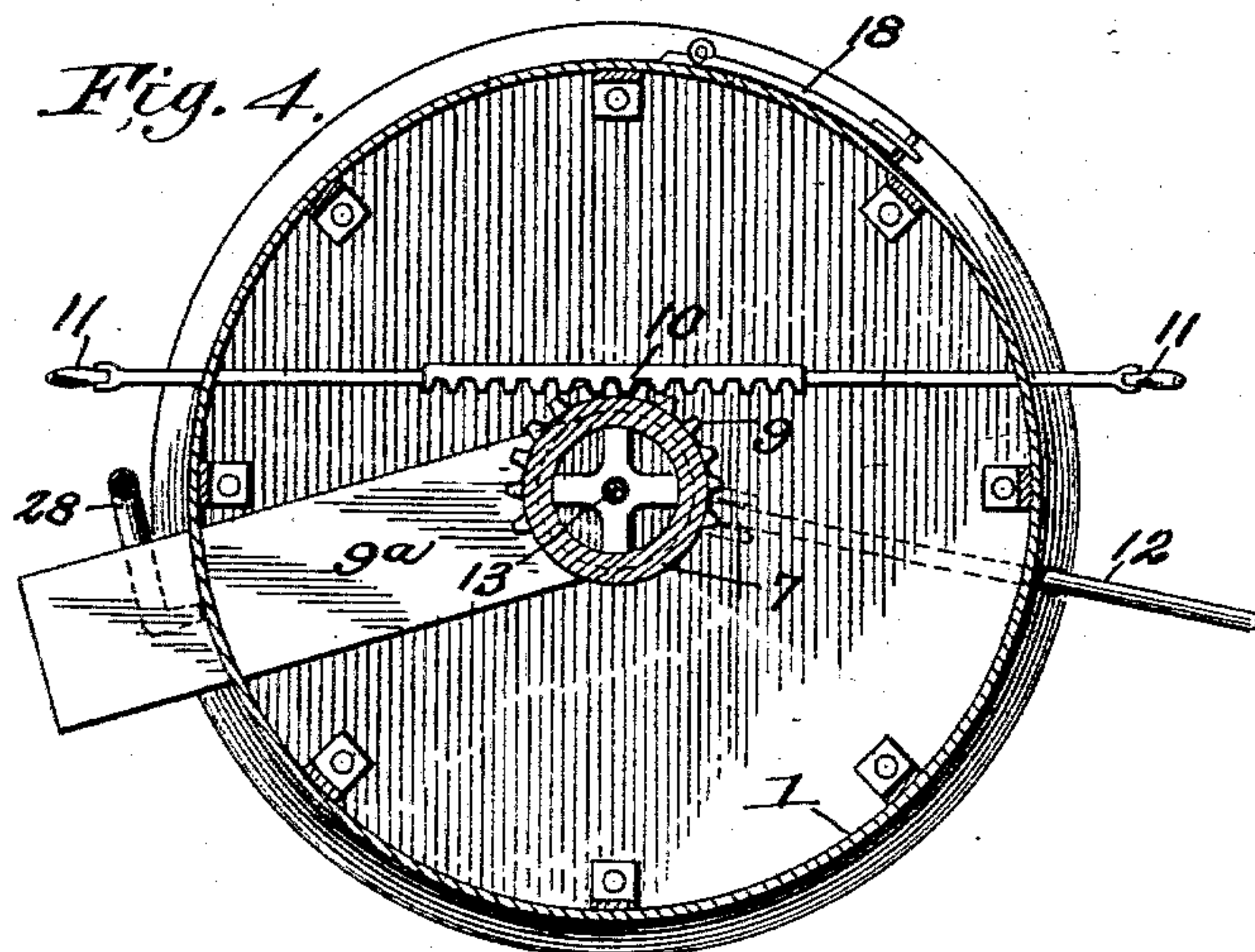


Fig. 5.

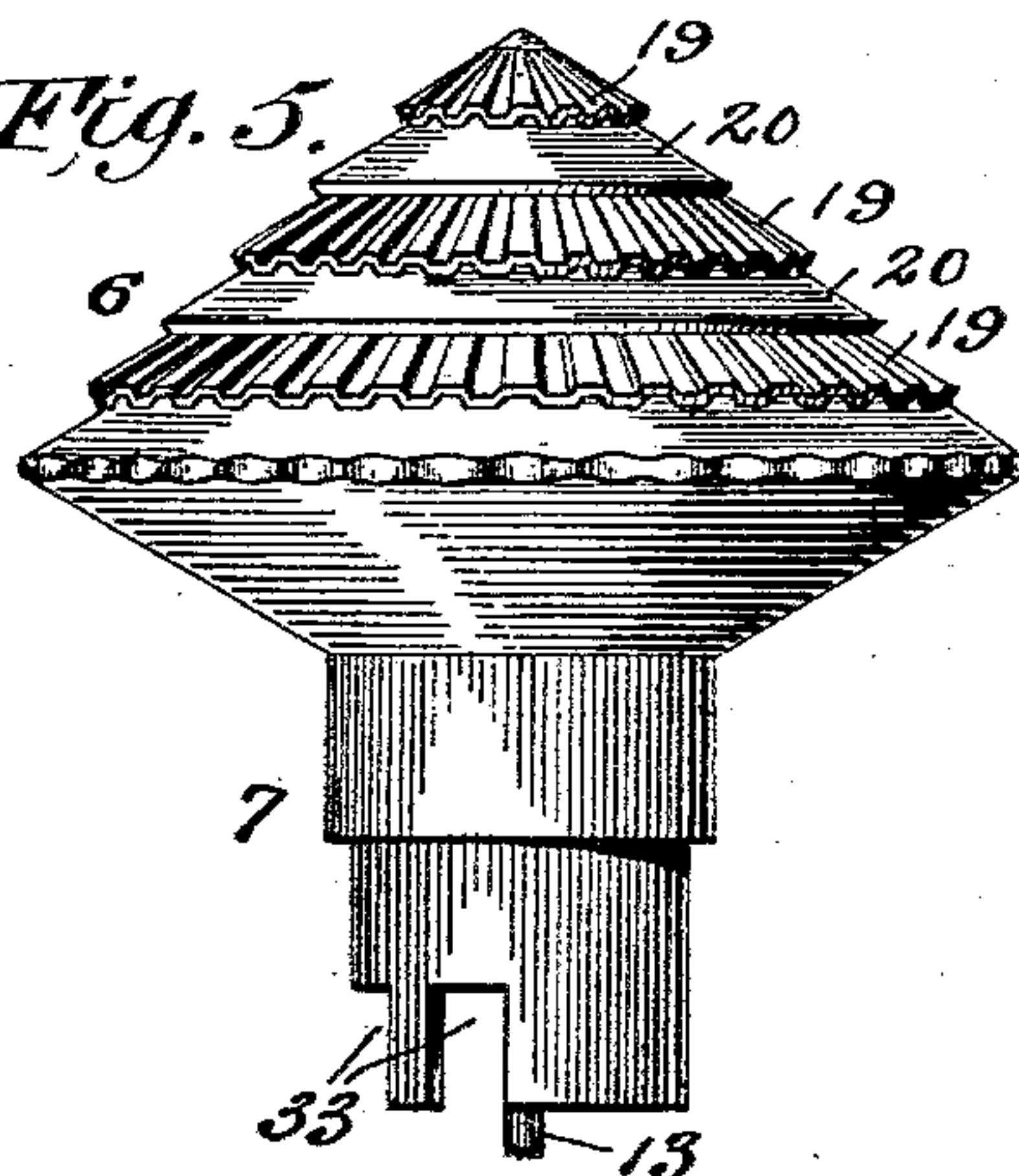
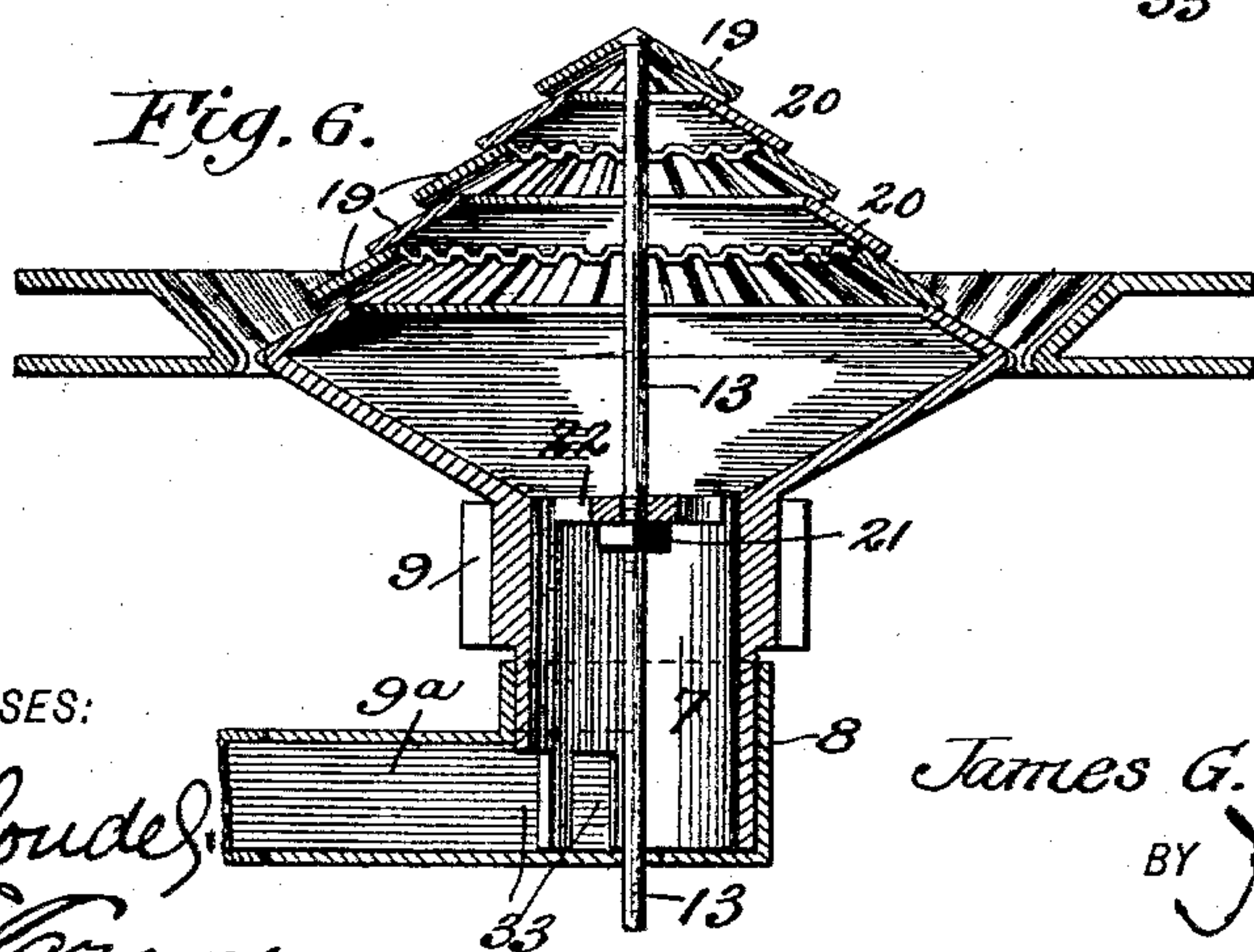


Fig. 6.



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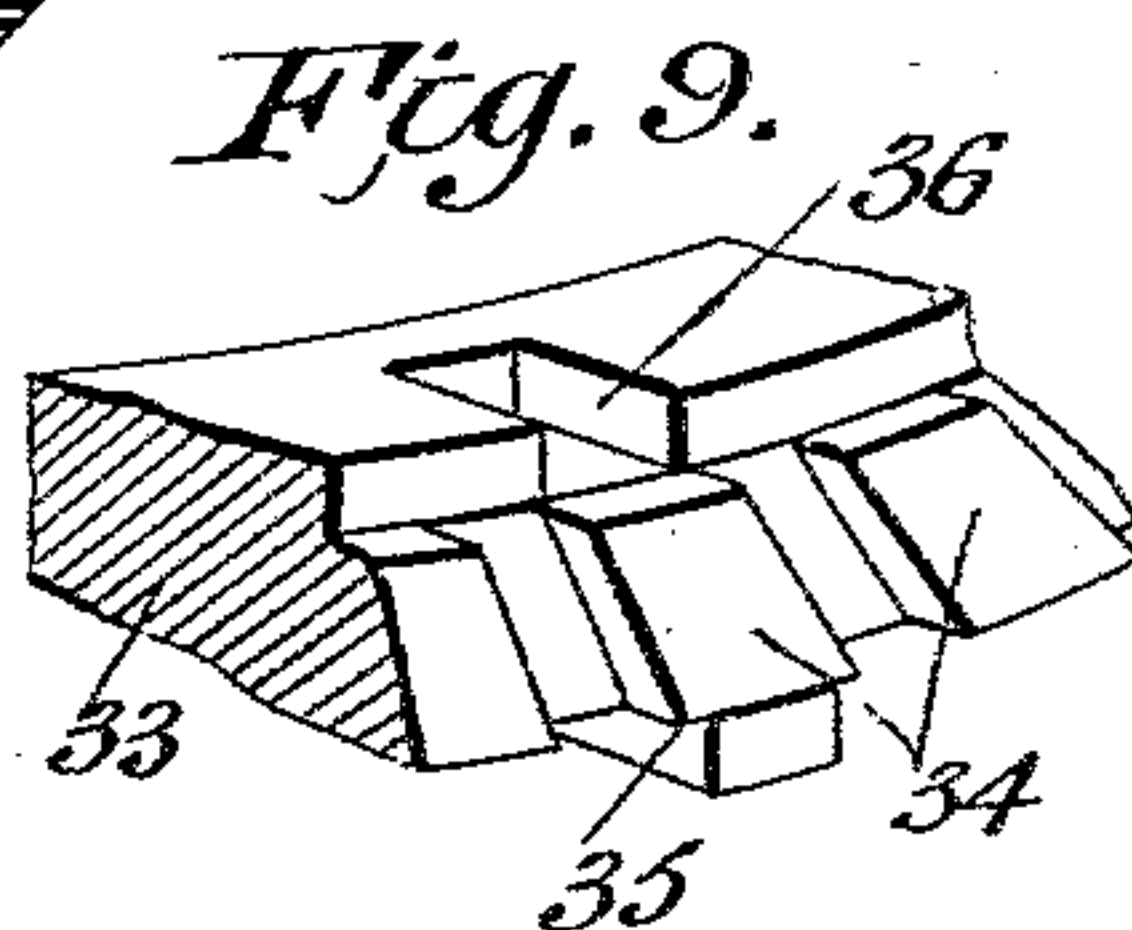
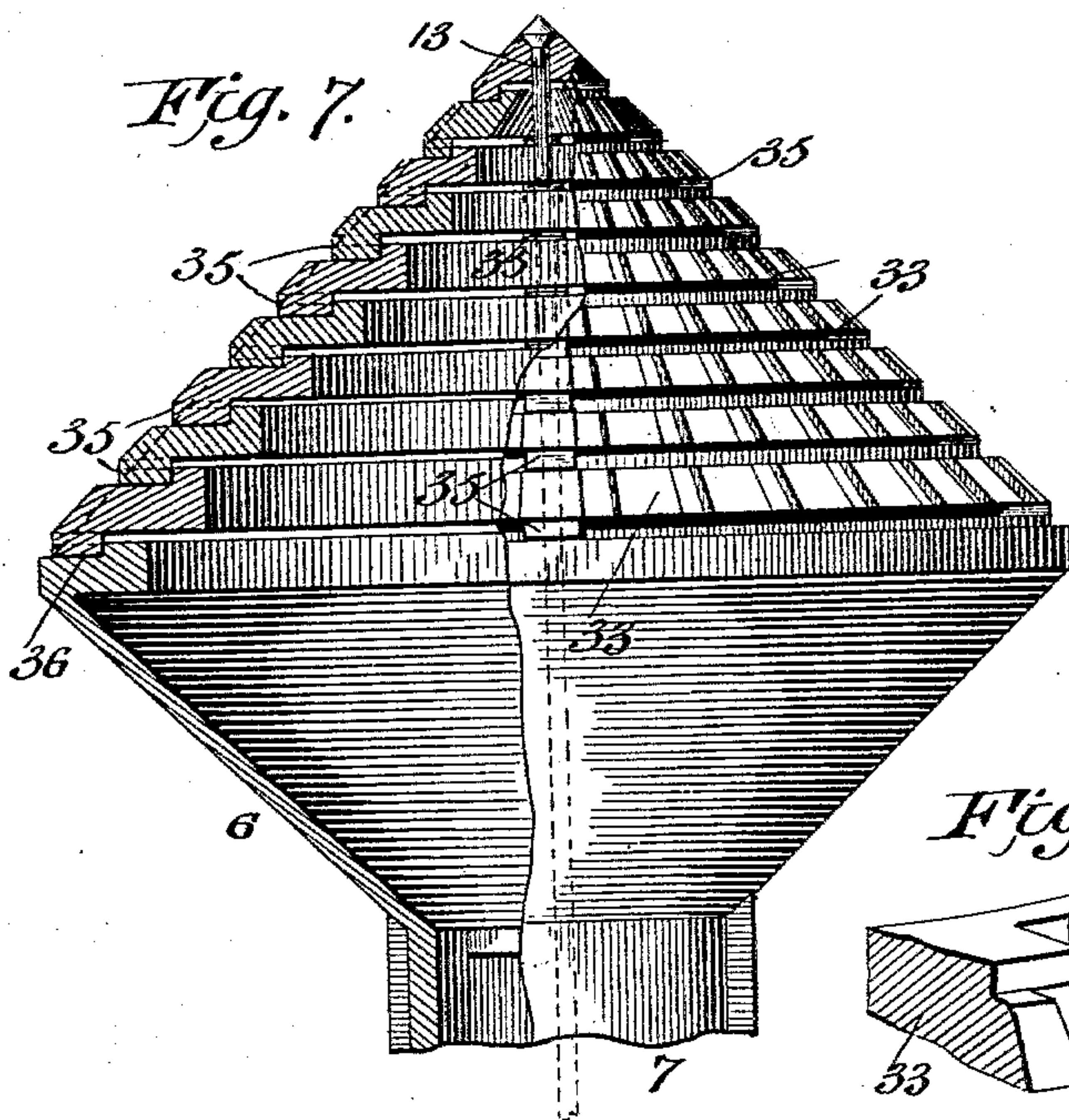
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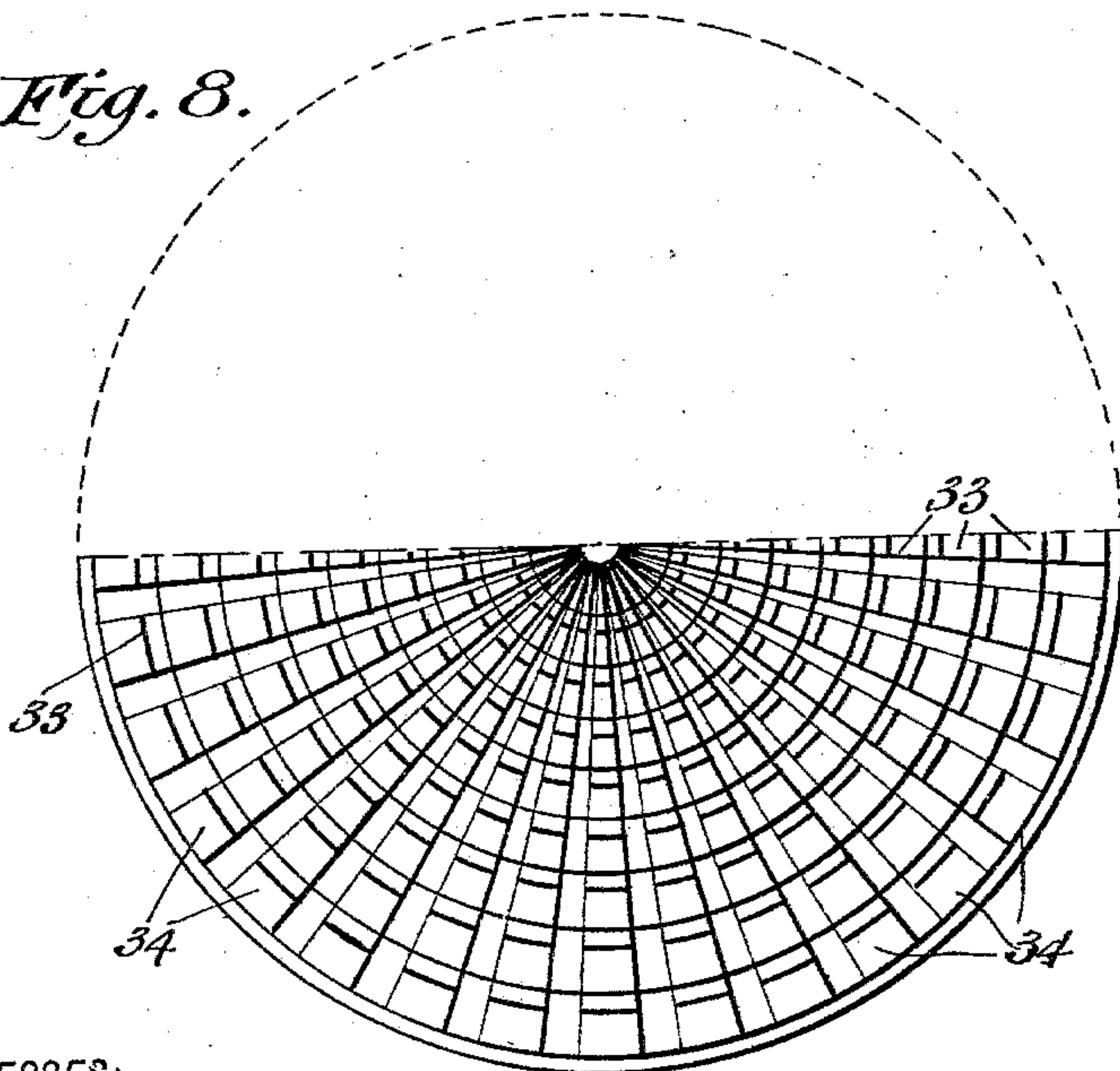
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*Fig. 8.*



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# UNITED STATES PATENT OFFICE.

JAMES GARDNER SANDERSON, OF SCRANTON, PENNSYLVANIA.

## FURNACE AND GRATE.

SPECIFICATION forming part of Letters Patent No. 561,729, dated June 9, 1896.

Application filed January 25, 1895. Serial No. 536,246. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES GARDNER SANDERSON, a citizen of the United States, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented certain new and useful Improvements in Furnaces and Grates, of which the following is a specification.

My invention relates to an improvement in furnaces, which may be used for either generating steam or producing gas, and it is especially designed for the use of small coals, such as coal-waste and anthracite-culm, which form a very good fuel for use in devices of this kind.

My invention consists, broadly, in the construction of the grate to be used and in the arrangement of devices for supplying the fuel and generating the gas and steam; and my invention further consists of certain details of novel construction and arrangement of parts, as will be hereinafter described, and pointed out in the claims.

In order that my invention may be fully understood, I will proceed to describe the same with reference to the accompanying drawings, in which—

Figure 1 is a vertical section of my improved device. Fig. 2 is a horizontal section taken on the line 2 2, Fig. 1. Fig. 3 is a horizontal section taken on the line 3 3, Fig. 1. Fig. 4 is also a horizontal section taken on the line 4 4, Fig. 1. Fig. 5 is a detail view of a modified form of grate. Fig. 6 is a detail vertical section of the form of grate shown in Fig. 5. Fig. 7 is an elevation, partly in section, of another modification of the grate. Fig. 8 is a plan view thereof, and Fig. 9 is a detail perspective of a portion of one of the rings forming the grate.

In the said drawings, 1 represents a boiler adapted to contain water and provided with the combustion-chamber 2, located within the boiler, the lower end of which is corrugated and tapers inwardly, the chamber 3, into which the products of combustion pass, and the exit-flue 4, which conducts away the products of combustion from the chamber 3.

5 represents a number of tubes connecting the chambers 2 and 3, through which the products of combustion pass. Thus it will be seen from the drawings that a large amount

of heating-surface is presented to the water in the boiler. I do not, however, claim this form of boiler as part of my invention.

6 represents my improved grate, located centrally within the combustion-chamber 2. The grate 6 is formed with the conical perforated head 6<sup>a</sup>, which is also corrugated, and with the tubular extension 7, the lower end of which fits in the cylindrical extension 8 of the passage 9<sup>a</sup>, through which air and steam are admitted to the combustion-chamber. The perforations in the head are of such size as will freely admit air to all parts of the chamber, but are not large enough to allow ashes or clinkers to pass through them.

As will be seen from the drawings, I have provided the extension 7 with a series of teeth 9, which are engaged by the teeth of the rack 10, secured at each end to the pivoted levers 11. By this means the grate is oscillated to shake the fire, and as it is oscillated the clinkers as they pass downward are ground between the corrugated surfaces of the head and tapering bottom of the combustion-chamber. Before the oscillation of the grate it is raised by means of the lever 12, which carries at one end the rod 13, secured to the grate at 14 and 15 in the manner shown. When the lever 12 is forced down, the grate is raised, forming an opening between the edge of the grate-head and the combustion-chamber which permits the ashes and clinkers to fall into the ash-pit 16 as the grate is oscillated from where they are removed through the opening 17, closed by the door 18. The oscillation of the grate is still permitted after it has been raised, owing to the length of the teeth formed on the tubular extension. The grate may be oscillated by means other than what is shown—as, for example, a rod may be connected to the tubular extension of the grate and extended to the outside of the ash-pits, and by the horizontal movement thereof back and forth the grate may be oscillated.

In Figs. 5 and 6 I have shown a modified form of my grate. In this form I employ a number of corrugated rings 19 and smooth rings 20, alternately arranged one upon another and secured together by the rod 13, the head of which is countersunk in the top ring and held therein by means of the nut 21, which is jammed against the web 22, carried



by the tubular extension of the grate. This form of grate is supplied with the same means for raising and oscillating it as shown in Fig. 1, and in this form the air and steam pass into the combustion-chamber through the passages formed by the corrugated and smooth rings.

In Figs. 7, 8, and 9 I have shown another modification of my grate. In this form I arrange and secure upon one another by the rod 13 and means shown in Fig. 5 a number of rings 33, formed with the projections 34 on their outer periphery, the lugs 35 on their lower faces, and with the openings 36 in their upper faces, and when the rings are secured together the projections 34 are in the same straight line one above the other, and the spaces intervening between them form the grooves 34<sup>a</sup>, as shown in Fig. 8. The lugs and openings are arranged on the rings in about the position shown. The lugs separate the rings to form lateral spaces between them through which air and steam pass, and the grooves 34<sup>a</sup>, which are in communication with the lateral passages, serve to conduct the air and steam up through the fuel. A further function of the lugs and openings is to prevent the rings from turning one upon the other when the grate is oscillated. This form of grate is also supplied with the means for oscillating and raising it shown in Fig. 1 and 5.

24 represents the hopper, 25 the chute for feeding the fuel to the chamber 2, and 26 a valve for closing the opening at the bottom of the hopper. As will be seen from Fig. 1, the chute 25 is placed centrally within the boiler and directly over the point of the grate, so that as the fuel is fed into the chamber it will be evenly distributed around in the chamber, as will be seen by the dotted lines in Fig. 1.

27 represents a steam-dome located on the boiler 1, and it may be, if desired, within the upper portion of the combustion-chamber, although I have shown it located outside of the furnace, and 28 a pipe leading therefrom to the passage 9<sup>a</sup>, at which point the end is tapered to form a jet and turned inward so as to direct the steam through the passage and openings 33 in the grate extension. By this arrangement a forced draft may be had in order to make the fire burn more rapidly when desired.

30 represents a water-glass, 31 a cock for drawing off water from the boiler, and 32 a feed-water inlet to the boiler, which is opened when the boiler is to be filled.

The operation of the apparatus is as follows: The hopper being supplied with fuel and the valve raised, the fuel falls through the chute onto the grate until the furnace is charged with fuel to the extent shown in dotted lines; but the hopper is filled to keep up a continuous supply of fuel. The fuel in the furnace being fired, combustion is aided by the draft through the passage 9<sup>a</sup> and the tu-

bular extension of the grate, through the opening in the grate-head, which distributes air throughout the fuel. Ordinarily, when the furnace is not being used to produce gas, the grate may be turned so that the openings 33<sup>a</sup> will be more or less in direct communication with the passage 9<sup>a</sup> and in this manner regulate the draft. The ash and clinkers formed by combustion of the fuel are removed by raising and oscillating the grate by the means already described.

If the device is to be employed to produce gas, for which it is well adapted, steam is supplied with the air to the combustion-chamber, and as it passes through the burning coals it is decomposed, forming hydrocarbon gas. When the device is used for this purpose, it is necessary to reduce the supply of air, only such quantity being needed as is necessary for slow combustion of the fuel. This may be accomplished by any suitable means. After the gas has passed up through the boiler it is conducted to where it is desired in the usual manner. The steam used for forming the gas may be taken from the steam-dome. It will also be seen that my furnace may be used for any of the purposes for which furnaces of the class are commonly employed.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. The combination of a grate, a rod secured thereto, a pivoted lever adapted to carry the rod at one end, a number of elongated teeth carried by said grate and adapted to be engaged by a rack, and suitable means for reciprocating the rack, substantially as shown and described.

2. A grate having a conical head formed of plain and corrugated rings alternately arranged; substantially as shown and described.

3. A hollow conical grate formed of plain and corrugated rings arranged alternately one upon the other, having draft-passages between the rings and provided with means for oscillating the grate, substantially as shown and described.

4. In a furnace, the combination of a suitable boiler, a vertical fuel-magazine located in said furnace, a combustion-chamber having a conical grate provided with a tubular portion having openings formed in it, located therein, said grate being hollow and having openings from the interior to the combustion-chamber, a draft-passage in communication with the tubular portion of said grate, and suitable means for turning the grate so as to regulate the draft; substantially as and for the purpose set forth.

5. In a furnace, the combination of a combustion-chamber having a corrugated tapered lower end, a corrugated conical grate fitting in the lower end of said combustion-chamber and having connected therewith suitable means for raising it within the combustion-



chamber and at the same time oscillating it, substantially as shown and described.

6. In a furnace the combination of a combustion-chamber having a tapered lower end, 5 a grate having a conical head, a rod secured to said grate, a pivoted lever adapted to carry the rod at one end, and to be operated at its other end to raise the grate, a series of teeth carried by said grate, a rack in engagement 10 therewith and a lever secured to the rack for reciprocating it, substantially as shown and described.

7. A conical grate made of a number of superposed rings resting one upon another 15 with their parallel faces overlapped to prevent the escape of fuel and spaced apart to form lateral air-passages and having grooves on their surface in communication with the lateral air-passages, substantially as and for 20 the purpose set forth.

8. A hollow conical grate formed of a number of superposed rings each being provided with openings and lugs, and with lateral pro-

jections for forming an intermediate space substantially as shown and described. 25

9. A hollow conical grate formed of a number of rings, each being provided with lugs and openings adapted to fit in a corresponding opening and receive a corresponding lug 30 on a superposed ring for the purpose of spacing the rings apart and prevent any relative movement of the rings, substantially as shown and described.

10. A furnace having a fuel-magazine, a combustion-chamber with an inwardly-inclined base, a conical grate located beneath 35 the magazine and within the combustion-chamber, a vertical rod supporting the said grate, a pivoted lever supporting the said rod, and a lever having means in connection there- 40 with for revolving or oscillating the grate, substantially as shown and described.

JAMES GARDNER SANDERSON.

Witnesses:

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