(No Model.) 3 Sheets—Sheet 1.

T. THORNTON.

SPARK ARRESTER.

No. 332,628. Patented Dec. 15, 1885.

Fig. 1.

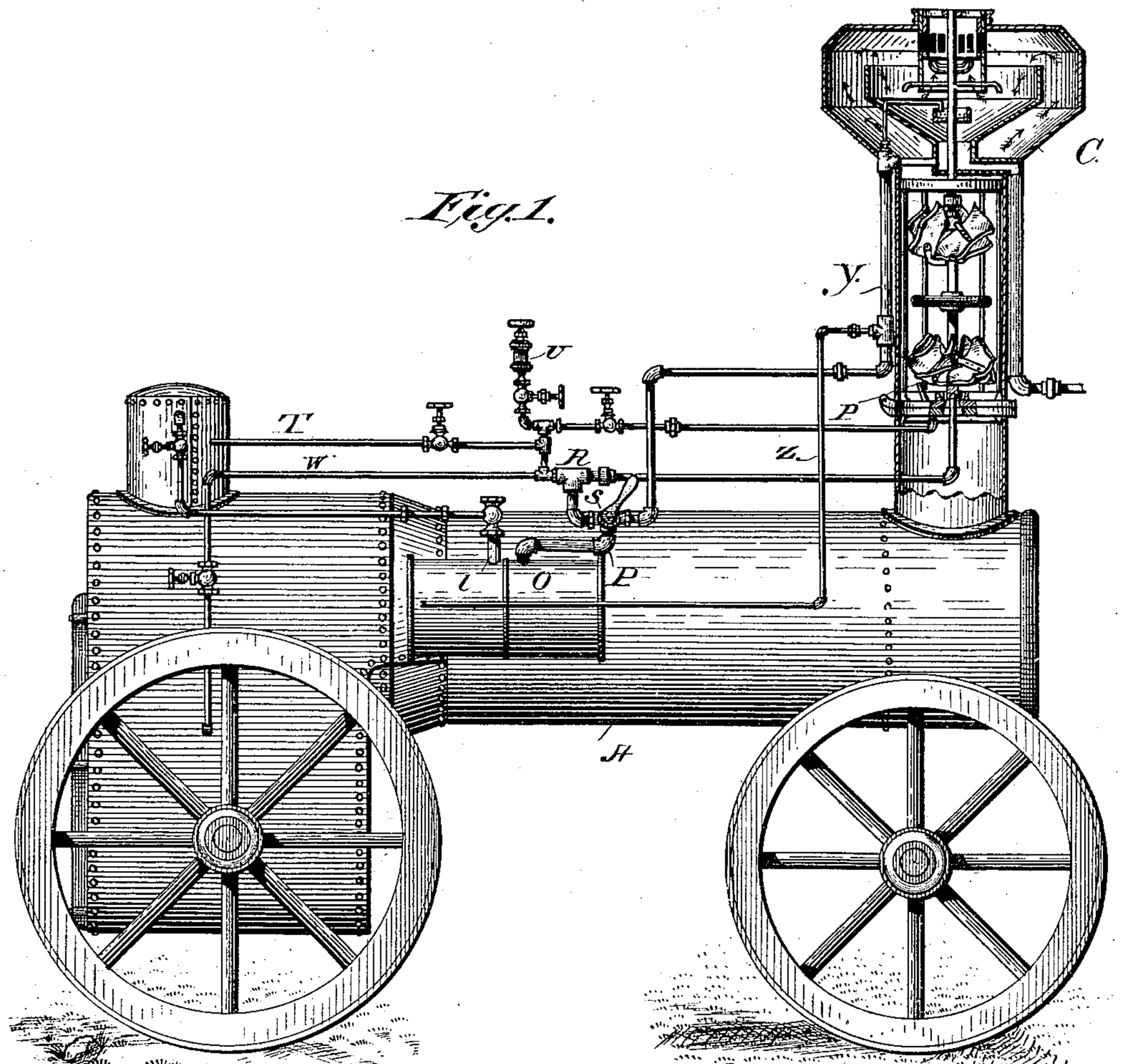
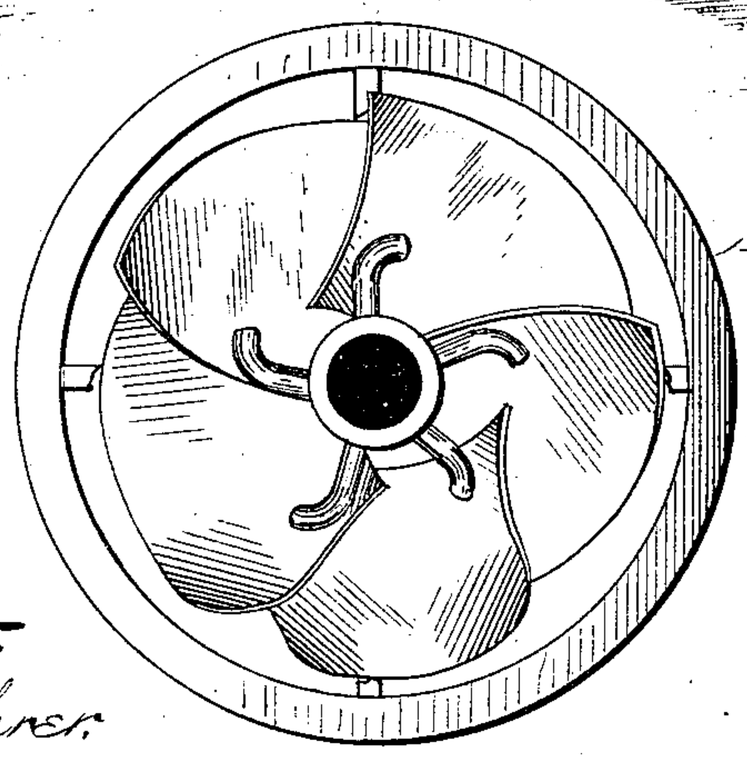


Fig. 4.



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(No Model.) 3 Sheets—Sheet 2.

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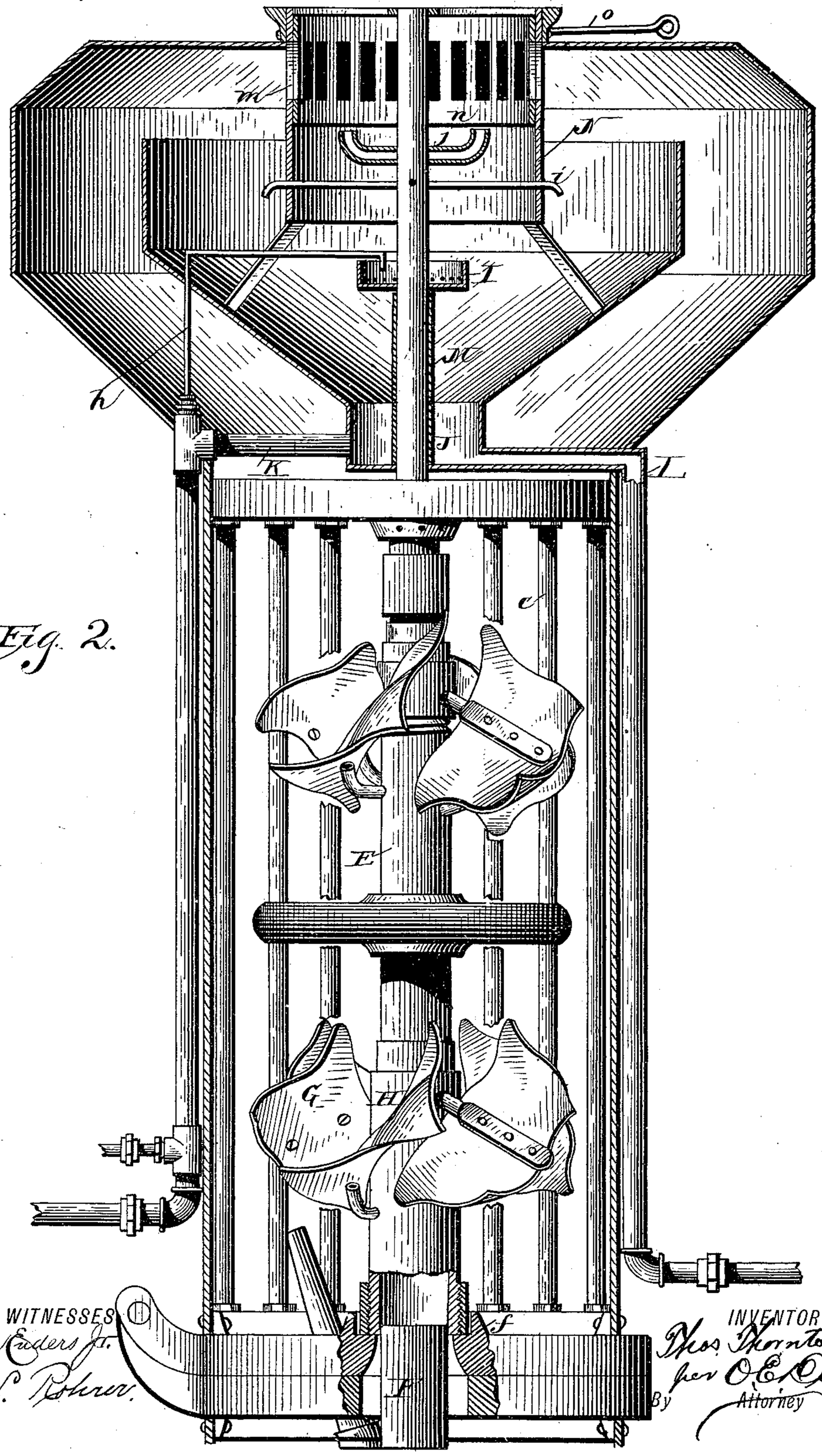

Fig. 2.

(No Model.) 3 Sheets—Sheet 3.

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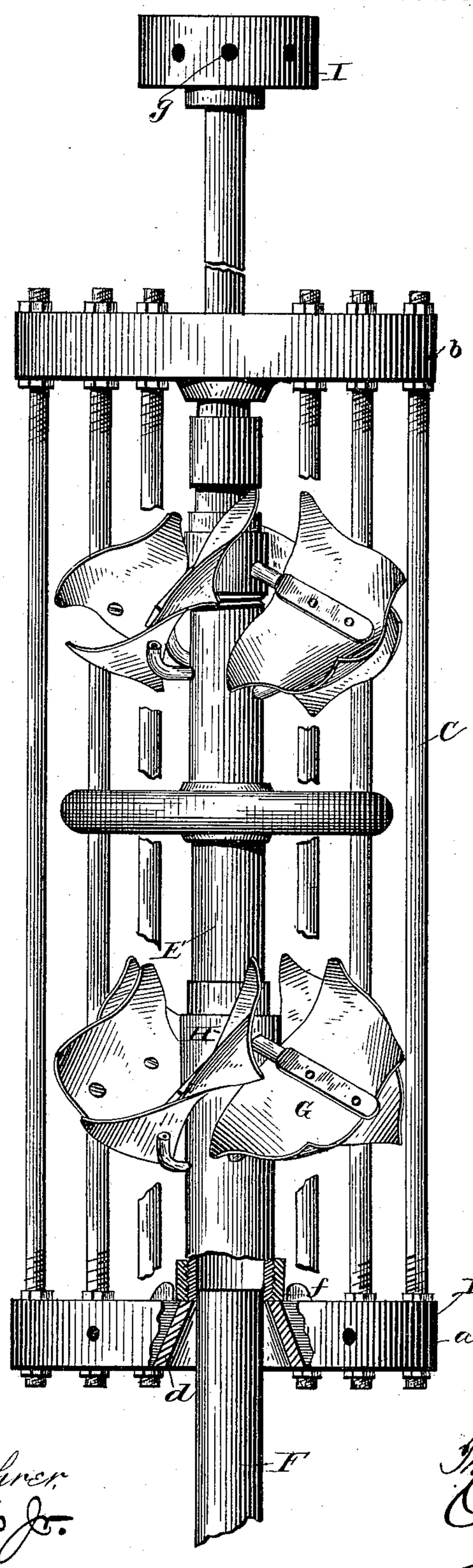
Fig. 3.



WITNESSES

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UNITED STATES PATENT OFFICE.

THOMAS THORNTON, OF TIDIOUTE, PENNSYLVANIA.

SPARK-ARRESTER.

SPECIFICATION forming part of Letters Patent No. 332,628, dated December 15, 1885.

Application filed August 22, 1885. Serial No. 175,096. (No model.)

To all whom it may concern:

Be it known that I, THOMAS THORNTON, of Tidioute, in the county of Warren and State of Pennsylvania, have invented certain new and useful Improvements in Spark-Arresters for Locomotives and Portable Engines; and I do hereby declare that the following is a full, clear, and exact description of the invention, such as will enable other skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form part of this specification.

This invention has relation to that class known as "spark arresters and extinguishers," and has for its object to arrest the sparks in the uptake or stack and extinguish them on their passage to the open atmosphere, and to also increase the draft in the furnace, whereby green or wet fuel may be used, and also doing away with the necessity of transporting a long stack, which is difficult to set up as well as very expensive to transport. I utilize for producing the draft the exhaust-steam, which heretofore in portable engines has been partially wasted.

To this end my invention consists in locating in the stack a rotary wheel having vanes arranged somewhat on the plan and angle of a propeller, said vanes being mounted on a hollow shaft which extends and is in communication with a series of small steam-nozzles, which causes the escaping steam from said nozzles to impinge against the inclined sides of the propeller-vanes and cause them to rotate rapidly, and while in motion the sparks and cinders in escaping up the stack come in violent contact with said vanes and are whirled and kept in a state of agitation until they are ground to fine dust, and are then subjected to either a bath of saturated steam or water, either from an injector or from the water-space of the boiler, by which they are extinguished.

It also consists of other features of construction which will be hereinafter more fully described, and particularly pointed out in the claims.

In the drawings, Figure 1 represents a side elevation of land or portable engine, showing the stack or uptake in section, also the connecting or communicating pipes; Fig. 2, a sectional elevation of the stack upon an enlarged scale; Fig. 3, an elevation of the frame-vanes, hollow shaft, nozzles, and extinguishing-cup, which by itself without the top shown in Fig. 2 will give good results; and Fig. 4, an end view of that shown in Fig. 3.

I will now proceed to describe my invention in detail, in which A shows the boiler, B the engine, and C the uptake or stack. D is the frame-work in which the spark-arrester works, and is composed of two annular skeleton wheels, *a b*, which are held together by stud-bolts *c*. This frame-work may be readily put together or taken apart for shipment or transportation. These stud-bolts perform two functions—*i. e.*, tie-bolts and disintegrating-surfaces, against which the sparks and cinders are violently thrown. When the frame is put together it is cylindrical in shape. The upper surface of the lower hub forms a bearing for the hollow shaft E, into which the exhaust-escape pipe F enters. This exhaust-pipe F extends slightly above the lower hub, *d*, and fits into the lower end of the hollow shaft E, and holds said shaft in position. The bore of the hub *d* is flaring from the bottom, so that when the stack is tipped over it will not disturb the end of the exhaust-pipe F. The hub *d* has also formed on its upper surface projections *f*, which serve as a stay or guard for the end of the hollow shaft. The hollow shaft E may be made of pipe, which will answer all purposes and be at the same time very cheap.

The bore of the shaft F is contracted at its upper end in such manner as to make a steam-bearing, so that when the apparatus is in full operation the pressure of steam against said surface is nearly sufficient to bear the weight of the rotary wheel and shaft. Another object of contracting the shaft at the top is to cause the steam to discharge through the nozzles with greater force. Should the shaft and nozzle be of the same size, the force of the steam would not produce the desired effect, although the end of the pipe might be entirely stopped and only sufficient steam admitted to drive the vanes of the wheel. The oil or lubricant passing off with the exhaust from the engine will be ample to lubricate the journal-bearings

without further expense or trouble. The shaft is provided with a small fly or balance wheel, *g*, for the purpose of overcoming the intermittent action of the exhaust-steam.

At or near each end of the shaft E, I locate my spark-arrester and draft-producing vane-wheels G, which are secured by means of arms or brackets to a hub, or collar, H, which are also secured to the hollow shaft by any suitable means. The upper end of shaft E is provided with perforations for the escape of the saturated steam or water for lubricating the journals in the upper hub. On the same shaft E, which is continued above the cylinder-cage D, but of smaller diameter, I locate a cup or chamber, I, perforated on all its sides with smaller holes *g*, and into the cup I lead a pipe, *h*, which pipe is either connected to the water-space of the boiler or to the injector. The object of this pipe is to supply water to the cup, which is sprayed out through the perforations and extinguishes any live sparks that might escape the extinguisher below.

This device, as far as I have described, will in operation give splendid results, but for some kinds of fuel it might not be sufficient; and in order to provide for any contingency, and make the stack applicable to all kinds of fuel, I arrange in the hood or cap a supplemental arrester and extinguisher, whereby the apparatus is made perfect; hence, when it is desired to use all the features of my invention in one stack, I extend the shaft E from the base of the stack to its upper extremity, and all of the features hereinbefore described, and add above the rotary chamber J, into which leads a pipe, K, and an exit-pipe, L. The pipe K supplies a stream or water-jet into the chamber J and forces out the sparks, cinders, or other resultant mixture caused by the smoke, ground sparks, and cinders out through the pipe L to any convenient place of deposit. The chamber J also receives the water which drips from the cup I. Around the upper portion of the shaft E, and between the chamber J and cup I, I locate a sleeve, M, which prevents any foreign substance, such as sparks, cinders, or the like, from getting into the journal of the wheel formed in the upper hub. Further, upon the shaft E, I arrange a series of spray-pipes, *i*, having downwardly-bent ends or nozzles, which throw sprays of wet steam down in the smoke-passage formed between the inner tapering receptacle and the pendent cylindrical baffle-plate N. Above the pipes *i* is another series, *j*, having upturned ends, which serve to create a draft upward, and also serve to extinguish any possibly escaping live sparks from below. The depending cylindrical exit N is provided with smoke-escape holes *m* and an inner cylindrical valve, *n*, to register with said escape-holes, so that when it is desired to have a direct draft the valve and holes are opened. This is essential when the fires in the furnace or fire-box are first lighted; but when the spark-arrester is in full motion the valve *n* is closed, so that the smoke is made to dive and pass up through N, where it is subjected to a final extinguishing-shower of steam or water. The valve *n* may be opened or closed by means of a suitable lever, *o*.

Between the steam-dome, the engine, and the stack, I locate an apparatus for injecting the exhaust-steam, water, and live steam, which will be seen by referring to Fig. 1, on which the supply and exhaust steam pipes are shown.

o is the engine-cylinder, provided with the usual appliances.

i is the live-steam and P the exhaust pipe.

R is the exhaust-injector, and has located between it and the exhaust-pipe of the engine a graduated valve, S, which, when desired, controls the volume of exhaust to the atmosphere and through the exhaust-injector R, as occasion may require, and according to the amount of draft required and the kind of fuel used. The regulating-valve can be set to throw all the exhaust one way or the other, or any portion of it. The exhaust-injector has a live-steam nozzle running through it, so as to carry off the exhaust as fast as it leaves the exhaust-port of the engine, relieving the engine of any back-pressure, and really assisting the engine by causing a partial vacuum on the exhaust side of the piston. Another object of using a live-steam jet is to operate the extinguisher when the engine is at rest, by means of independent live-steam nozzles *p*, operated on the rotary vanes. Thus a draft up the smoke-stack is formed and the fire accelerated.

T is the live-steam pipe, which supplies both the exhaust-injector R and the live-steam nozzle *p*. These branches of pipes are controlled by suitable valves.

U is a lubricating-cup from which the steam carries the oil to the journals in the uptake, should such be necessary, as it is held that the exhaust-steam carries sufficient lubricant for this purpose from the engine.

W is a water-pipe which may be used in connection with the injector to saturate the steam when it is too dry or when it becomes superheated.

Y is a go-by pipe, which will convey to the top of the spark-arrester as large a portion of the exhaust-steam as may be determined by means of the controlling-valve S. Should cold water be required in the spark-extinguishing cup, it may be conveyed from the pump by means of the pipe Z through pipe Y.

From the above description it is thought that the operation will be readily understood. All the pipes connected with the pipes above the tilting joint are provided with union-joints, so that they may be easily detached.

It is evident that the arrangement of pipes may be variously modified or the location changed without departing from the spirit of my invention.

Claims for the system of piping, together

with injector, will form the subject-matter for a separate application, which will be filed simultaneously herewith, serial number of which is 175,095.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with the smoke-stack, of a rotating disintegrating-wheel provided with propeller blades or vanes curved as described, a central hollow stack adapted to rotate, and steam-nozzles for propelling said wheels by causing the steam to impinge against said vanes, as set forth.

2. The combination, with a smoke-stack, of a spark arrester and extinguisher, the latter consisting of a cylindrical cage having wheels at each end, the hubs of which form journals, and a hollow shaft adapted to rotate, said shaft having curved vanes, and steam-nozzles for throwing the steam against said vanes for rotating the shaft, for the purpose set forth.

3. A hollow shaft contracted at its end and carrying spark arresting and disintegrating wheels, and steam-jet nozzles arranged to cause the steam to impinge against the curved vanes of said wheel for rotating it, in combination with a smoke-stack, substantially as set forth.

4. In combination with a smoke-stack jointed to tilt near its base, a spark arrester and extinguisher composed of a cylindrical cage having hubs which form journals, and a hollow shaft into which an exhaust-pipe enters, the lower hub of said cage having a flaring entrance to permit its tilting without disturbing the exhaust-pipe, in the manner shown and described.

5. A smoke-stack having a spark arrester and extinguisher rotating on a hollow shaft, in combination with a perforated cup forming a supplemental extinguisher and a spark and cinder arrester, the latter having discharge-pipes, as described.

6. The combination, with a smoke-stack having arresting, extinguishing, and disintegrating devices, of a dead spark and cinder receptacle, and a supplemental rotating extinguishing device arranged in the cap or hood of said stack, and a dependent valved escape-cylinder, all operating together substantially as described.

7. As an attachment for smoke-stacks, a spark arrester, extinguisher, and disintegrator constructed and arranged to rotate within a stack, in combination with a supplemental extinguisher and a down-jet to draw the cinders downward in their passage, and an up-jet to draw them upward to their exit, substantially as shown.

8. In a smoke-stack for locomotives and portable engines, the combination of the main spark-arrester having vanes and nozzles for rotation, a fly or balance wheel, and a supplemental spark-extinguisher, and means for creating an upper draft therein, and with supply and exit pipes, all arranged for joint operation substantially as herein shown and described.

9. The combination, in a smoke-stack, of a spark-extinguisher having a hollow shaft, the bore of which is of unequal diameter, and adapted to carry disintegrating-wheels and extinguishers, the said hollow shafts having also communicating steam-nozzles, as described, and a stationary live-steam nozzle secured in the stationary portion of the stack, all arranged to operate substantially as described.

In testimony that I claim the foregoing as my own I hereunto affix my signature in presence of two witnesses.

THOMAS THORNTON.

Witnesses:
O. E. DUFFY,
F. R. HARDING.