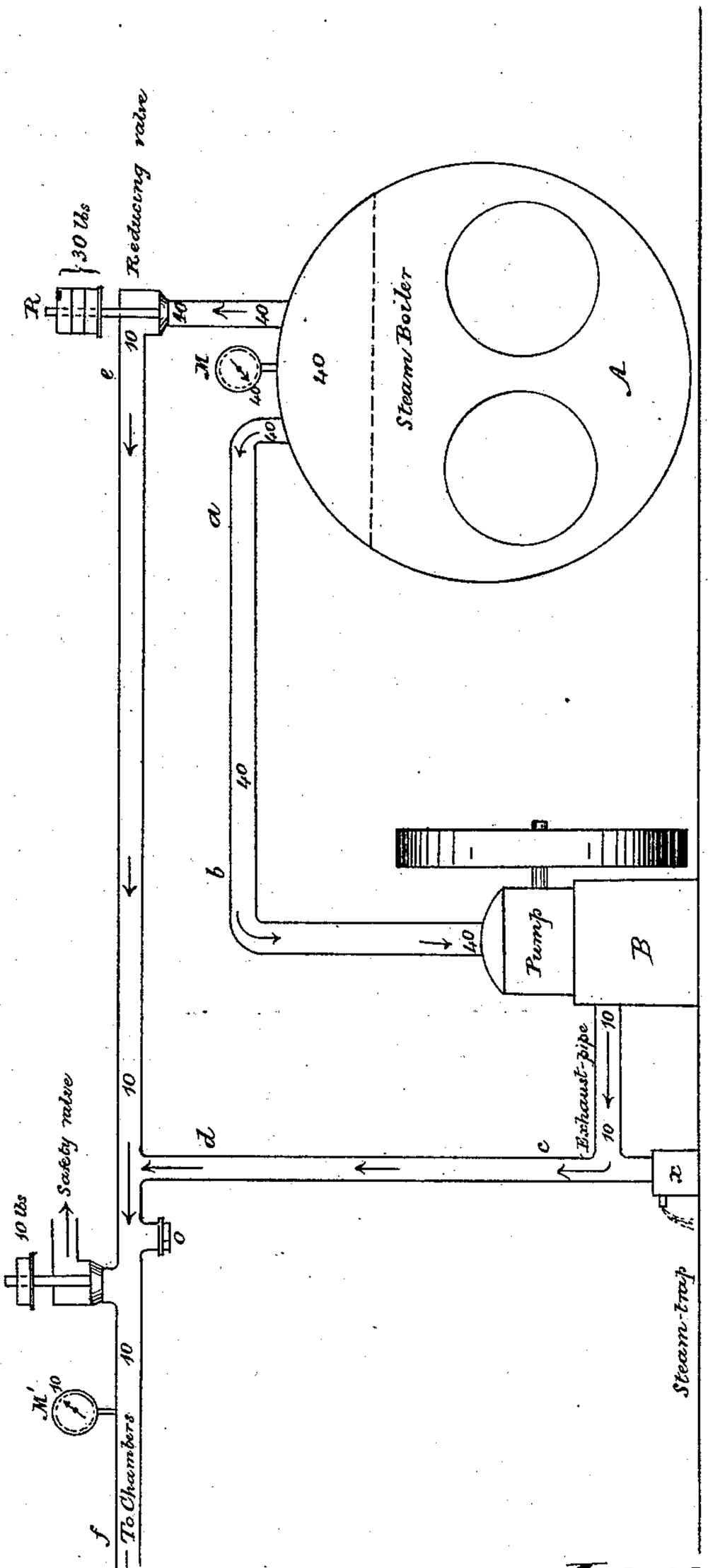
(No Model.)

H. J. P. SPRENGEL.

OBTAINING SULPHURIC ACID BY THE AID OF WASTE STEAM.

No. 357,107. Patented Feb. 1, 1887.



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UNITED STATES PATENT OFFICE.

HERMANN J. P. SPRENGEL, OF PIMLICO, COUNTY OF MIDDLESEX, ENGLAND.

OBTAINING SULPHURIC ACID BY THE AID OF WASTE STEAM.

SPECIFICATION forming part of Letters Patent No. 357,107, dated February 1, 1887.

Application filed September 28, 1886. Serial No. 214,769. (No specimens.) Patented in England August 24, 1886, No. 10,798.

To all whom it may concern:

Be it known that I, HERMANN JOHANN PHILIPP SPRENGEL, a subject of the Emperor of Germany, residing at Pimlico, in the county of Middlesex, England, have invented certain new and useful Improvements in the Production of Sulphuric Acid, (for which I have obtained a patent in Great Britain, No. 10,798, bearing date August 24, 1886,) and of which the following is a specification.

Mechanical operations—such as the pumping of water and the compressing of air—absorb in sulphuric-acid works which possess Gay-Lussac and Glover towers a not inconsiderable amount of steam, and consequently of fuel. This steam, after having spent its energy in the engines, is, as a rule, allowed to escape into the open air. It is obvious that this escaping steam—the so-called "exhaust-steam"—might render a second service by virtue of its chemical properties, if it could be made to substitute, without much trouble and expense, a part of another quantity of steam, which in sulphuric-acid works has to be raised almost entirely for the sake of a chemical operation—viz., the formation of acid inside the leaden chambers. This problem I have solved in the following manner.

Be it remembered that the work done by a steam-engine is the result of the difference of pressure which exists alternately on the two sides of its piston. Supposing this pressure be thirty pounds per square inch on the one side and *nil* on the other, the work done will be due to the difference of those thirty pounds per square inch; hence the same work may be done by the same engine if the pressure be kept at forty pounds per square inch on the one side of its piston and at ten pounds per square inch on the other, for the difference of pressure remains unaltered, or thirty pounds per square inch.

In factories of an average size not more than one steam-boiler serves, as a rule, to supply steam of a uniform pressure of about thirty pounds per square inch both to the engines and to the chambers. As, however, a pressure of ten pounds per square inch is ample and to spare for the steam entering the chambers, I now, in harmony with the above view, first raise the pressure in such a steam-boiler by ten pounds per square inch—*i. e*, in this case from thirty pounds to forty pounds; second, drive the engines at this higher pressure; third, make the exhaust-steam from the engines enter the chambers at a pressure of ten pounds per square inch; and, fourth, supplement, when needed, any deficiency of steam in the chambers by another quantity of steam of the same pressure—*i. e.*, steam of ten pounds per square inch—drawn from this very boiler, which is kept at a constant and regular pressure of forty pounds per square inch. How this may be done in a convenient and inexpensive manner will be readily understood by referring to the annexed diagrammatic sketch.

A represents a steam-boiler, and B a pump supplied with steam of a constant pressure of forty pounds per square inch by the pipe *a b*. The exhaust-steam of this pump escapes through *c d* into the main steam-pipe *e f*, which carries steam of a pressure of ten pounds per square inch to the chambers. This main steam-pipe *e f* is connected with the steam-boiler A, and is provided with two valves—first, a reducing-valve, R, and second, a safety or escape valve, S. These two valves are weighted in such a manner that as soon as the pressure in *e f* becomes less than ten pounds per square inch the valve R will admit steam from the boiler until a pressure of ten pounds is re-established in *e f*, while as soon as the pressure in *e f* becomes more than ten pounds per square inch the valve S will allow an escape of steam into the open air until a pressure of ten pounds is re-established in *e f*. In other words, and by way of an example, a forty-pounds pressure in the boiler will lift and overcome a thirty-pound weight, plus a nine-and-one-half-pound counter-pressure of steam at R, while a ten-and-one-half-pounds pressure in *e f* will lift a ten-pound weight at S. Thus it will be seen that one boiler and one system of pipes are sufficient to supply simultaneously both the engines with high-pressure steam and the chambers with low-pressure steam. To insure what is much to be desired, an even, constant, and regular pressure in *e f*, it is essential that these valves R and S should be sensitive, or, in technical language, not be liable to "stick."

M and M′ represent manometers for indi-

cating the pressure inside the boiler A and the pipe *e f*, while *x* represents a steam-trap and an outlet for condensed steam, which in the form of water will collect in the pipes above *x*.

In the same way, as the exhaust-steam from only one pump is shown here to be utilized, so the exhaust-steam from two or more pumps may be utilized by connecting the same with *e f*, for instance at *o*. As an experimental proof it may be mentioned that by utilizing in this manner the exhaust-steam from four small engines attached to the water-pumps and air-compressors at the works of the Lawes' Chemical Manure Company, Creeks Mouth, Barking, Essex, I have been able to dispense with one of two steam-boilers formerly in use, thus reducing the consumption of coal thirty-four per cent., the quality of coal and the amount of work done remaining unaltered.

Though this invention relates, in the first instance, to the utilization of exhaust-steam of engines which are to be met with in every sulphuric-acid works possessing Gay-Lussac and Glover towers, it is obvious that the exhaust-steam from any other engine which happens to be discharged into the open air in the vicinity of sulphuric-acid chambers may be utilized as before described, even if this exhaust-steam should be derived from an engine supplied with steam from a different boiler at a different pressure, for the regularity of pressure needed in the chamber steam-pipes will thereby not be affected, but will still be maintained by the valves R and S. In fact, the use of exhaust-steam in the manufacture of sulphuric acid may be carried with advantage to the point at which the sum total of the thus collected quantity of exhaust-steam equals the total quantity of steam needed in the chambers; hence only after this point has been passed is there good reason to employ in the vicinity of sulphuric-acid chambers engines from which there is no escape of exhaust-steam, properly speaking—*e. g.*, the so-called condensing-engines.

Finally, I beg to state that I do not restrict myself to the above-stated pressure of forty and ten pounds per square inch as the only ones which may be used. I merely have mentioned these pressures as those at which I have obtained very satisfactory results.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

The method herein described of utilizing the exhaust-steam of the engine or engines in manufacturing sulphuric acid, which consists in leading the exhaust-steam from the engine or engines into the leaden chambers, to be utilized therein in the formation of the acid, substantially as set forth.

In testimony whereof I have hereto set my hand this 6th day of September, 1886.

H. J. P. SPRENGEL.

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