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S. A. REEVE.

SUPERHEATING SYSTEM.

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NO MODEL.

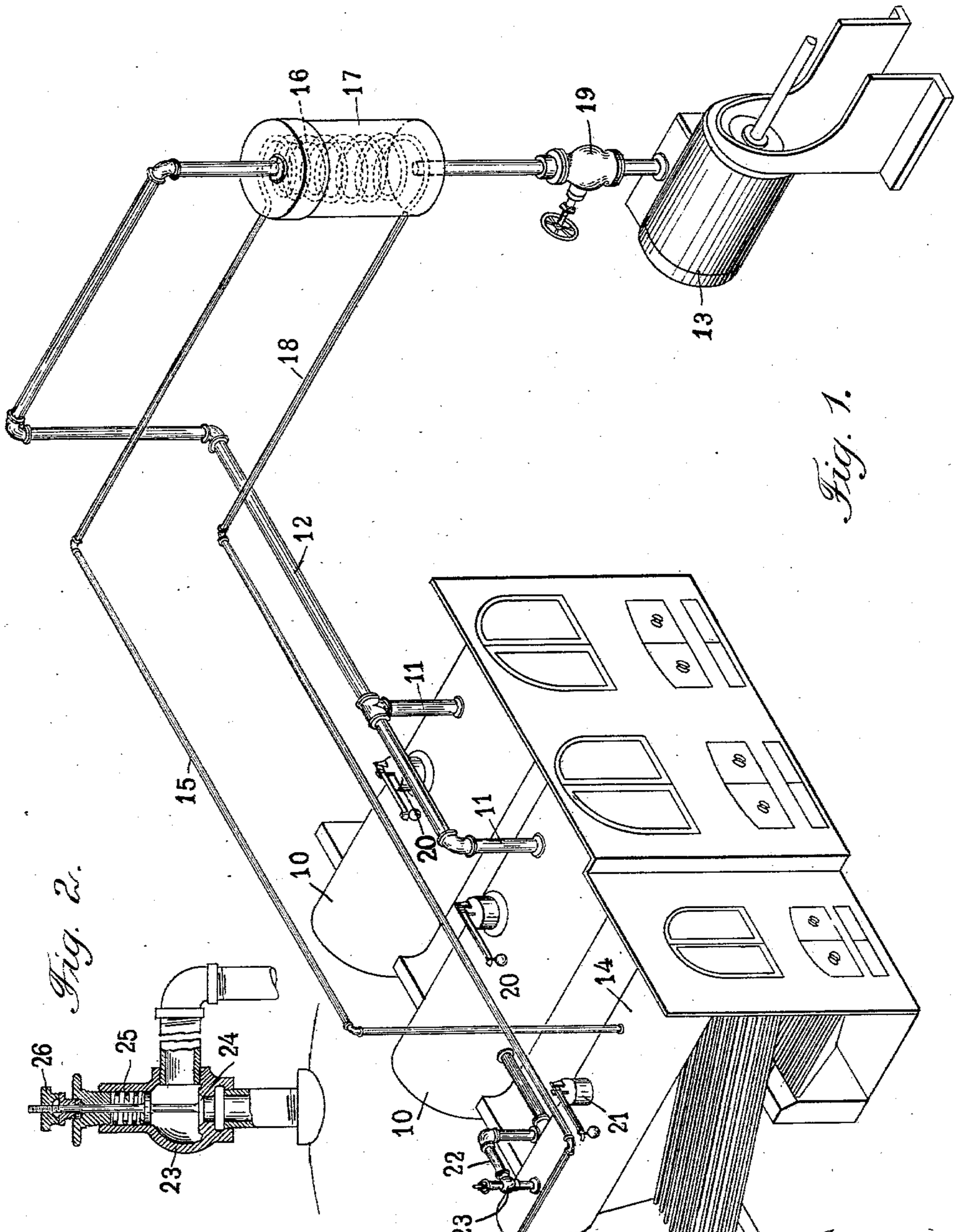

Fig. 1.

Fig. 2.

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UNITED STATES PATENT OFFICE.

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SUPERHEATING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 753,433, dated March 1, 1904.

Application filed April 27, 1903. Serial No. 154,405. (No model.)

To all whom it may concern:

Be it known that I, SIDNEY A. REEVE, of Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Superheating Systems, of which the following is a specification.

This invention has for its object to furnish to steam-engines or other devices a steam-supply having a moderate and constant degree of superheat.

In the superheaters which are familiar to the public the steam is supplied to the superheater in a saturated condition and is superheated by contact with metallic surfaces which are heated from the other side by hot gases coming more or less directly from the furnace-fire. Among the faults of this plan may be mentioned the following: first, rapid deterioration of the metallic surfaces, owing to their being exposed on one side to a hot dry steam gas and on the other side to a hot dry furnace-gas; second, rapid accumulation of soot and ashes on the fire side; third, slow heat transmission and large surfaces required for a given result because of the poor transmitting properties of dry gases and the accumulation of soot and ashes on the fire side of the surfaces; fourth, destructive effect on engine or superheater, or both, due to the wide variation in degree of superheat which takes place when a variation in the demand for steam or a variation in the supply of furnace-gases occurs.

The present invention consists in a superheating system or apparatus which obviates these faults and provides instead a stable supply of steam for the engine at a constant degree of superheat from apparatus of a durable nature independently of the variable conditions occurring in practice.

Of the accompanying drawings, Figure 1 represents a perspective view of a superheating system embodying my invention. Fig. 2 represents a sectional view of the release-valve controlling communication between the high-pressure and the low-pressure boiler.

The same reference characters indicate the same parts in both figures.

In the drawings, 10 10 are boilers of a standard type provided with suitable furnaces and in practice having the usual accessories, many of which I have omitted to show in the drawings, and 11 11 are branch steam-pipes connected to a steam conduit or supply pipe 12, which leads to a translating device, such as the engine 13.

14 is a boiler or steam-generator of a suitable type built to withstand pressures considerably higher than those employed in the boilers 10 and having a furnace and the usual accessories. A pipe 15 leads from the steam-space of the boiler 14 to a coil 16, contained in a drum or enlargement 17 in the steam-conduit 12, and from said coil a pipe 18 returns to the water-space of the boiler 14. Between the drum 17 and the engine 13 is a throttle-valve 19 in the steam-conduit 12.

20 20 are the safety-valves of the boilers 10, and 21 is the regular safety-valve of the boiler 14, set to release at a higher pressure than the valves 20.

22 is a release-conduit connecting the steam-space of the boiler 14 with the interior of one of the boilers 10 and containing a safety-valve mechanism 23, the valve 24 of which is loaded by a spring 25, so that when the difference in pressures between the boiler 14 and the boilers 10 exceeds the pressure of the spring communication will be established between said boilers 14 and 10. The stem of valve 25 has a nut 26, whereby the valve may on occasion be held permanently open. It is not essential that the release-conduit 22 shall connect directly with the shell of boiler 10, and in referring to this connection in the claims it will be understood that the term "steam-generator" or similar term includes also the piping and other connections of the boiler proper. The valve 21 is set to release at a higher pressure than the valve 23 and is not strictly a necessary element during the normal operation of the system.

In operation the boilers 10 10 supply steam in the regular way through the conduit 12 to the engine 13, the said steam passing through the interior of drum 17 in contact with the coil 16. The steam supplied by the boiler 14

to the coil 16 through pipe 15 being of much higher pressure than the engine-supply, and hence of a higher temperature, will superheat the steam in drum 17 by conduction of heat through the walls of the coil 16, and this superheating steam in the coil will be more or less condensed by the cooler steam in the drum. The water of condensation returns through pipe 18 to the water-space of the boiler 14, and if the coil 16 is elevated a gravity circulation is established. An artificial circulation can be substituted, if desired. As the superheating units 16 17 may be duplicated in different parts of the steam-engine apparatus and may be made of any desired size and capacity with respect to the boiler 14, it is permissible to normally absorb the bulk of 14's capacity for supplying steam. Should this not be the case, however, either because the boiler 14 is fired too strongly or because the draft through the drum 17 is too small, the surplus steam formed in boiler 14 passes through the valve mechanism 23 and conduit 22 into the boilers 10 10. The capacity of the latter being preferably much larger than that of boiler 14, they will under most circumstances be sufficient to store this steam coming from 14 for future use. If not, it escapes through the safety-valves 20 20 and gives warning of too hot fires. The only detrimental result would be a slight loss of efficiency. In practice the heat of the fires under the several boilers can be regulated approximately, according to the demand for steam, by the usual automatic appliances, such as damper-regulators, &c.

Several advantages of the invention will be evident, and among them may be named the following:

First. The surfaces taking the high-temperature heat from the fire (those of the boiler 14) are coated on their steam side by either water or wet saturated steam instead of by dry superheated gaseous steam, as in the ordinary superheater. They will therefore have the durability of an ordinary boiler.

Second. The surfaces imparting the superheat to the working steam (those of the coil 16) are coated at their upper end with wet saturated high-pressure steam on one side and with wet saturated low-pressure steam on the other side and at their lower end with very wet high-pressure steam or water of condensation on one side and with superheated steam on the other. The heat transmission per unit of surface will therefore be rapid.

Third. For the same reason these surfaces will be durable.

Fourth. As the temperatures are controlled by the pressure in the boiler 14, they are entirely independent of either the rate of firing or the rate of steam consumption in connection with the boilers furnishing the steam-supply to the engine.

Fifth. There is no danger to the engine from excessive superheat.

Sixth. No special knowledge or skill in attendance is necessary.

Seventh. The special construction and extra cost involved are only the cost of simple superheating devices, such as the coil 16 and drum 17 and the cost of extra strength in the boiler 14.

Eighth. At any time that operation under superheat becomes undesirable, either temporarily or permanently, the safety-valve 24 may be held open and the boiler 14 operated at low pressure, as one with the battery 10 10.

Ninth. The question of distance of location of the engine from the boiler-room as affecting the degree of superheat disappears. However much condensation may occur in either of the pipe-lines 12 or 15 18, due to distance, so long as the capacity of the boiler 14 is such that said boiler is able to maintain normal high pressure in the coil the degree and constancy of superheat will not be affected. In other words, the degree of superheat is determined solely by the pressure in boiler 14. This is easily kept constant under ordinary working conditions and will vary only when the engine is so overloaded that the capacity of either the boiler 14 or the coil 16 is exceeded. In such a case a portion of the normal superheat is lost; but the efficiency is not appreciably affected from this cause, because at overload superheat is of little effect in maintaining efficiency. This temporary loss of superheat does not affect the durability of the engine, as is the case with the ordinary superheater.

It will be understood that the details in the manner of practicing this invention may be considerably modified without departing from the principle involved. It will be further understood that the release-conduit 22 and safety-valve 23 are adopted principally as a measure of economy, so that should the boiler 14 be overfired steam will not be lost. In practice the proper pressures are intended to be maintained by proper firing and that of the boiler 14 would be kept below the pressure at which release occurs. There are also equivalent devices which might be made to subserve substantially the same function as the elements 22 23. Hence, although these elements or their equivalents would preferably be employed in a working apparatus, the process is normally carried on without calling their functions into action, and for this reason they are not absolutely essential to the invention in its simplest form.

The method herein described is made the subject of a separate application filed concurrently herewith, Serial No. 154,406.

Different equivalents may be employed for the form of superheater 16 17 herein shown; but for the best results with economy of space there should be, as in the device illustrated, two steam-chambers with a replicate division—that is, a wall or separating structure

whose convolutions, sections, units, folds, divisions, legs, tubes, or the like are repeated sufficiently to give the required heat-transferring surface.

I claim—

1. In a superheating system, a lower-pressure steam-generator for supplying working steam, a higher-pressure steam-generator for supplying steam to superheat the working steam, a superheater constructed with two chambers having a replicate division, and conduit connections between said chambers and the steam-spaces of the respective steam-generators.

2. In a superheating system, two steam-generators arranged for different steam-pressures, a translating apparatus having a conduit connection with the lower-pressure generator, and a superheater having chambers in heat-transferring relation, one of which is interposed in the connection between lower-pressure generator and translating apparatus, the other having a conduit connection with the higher-pressure generator.

3. In a superheating system, a generator for supplying working steam, a second generator for supplying superheating steam, conduit connections forming a loop emanating from the steam-space of the superheating-generator and returning to said generator, and a superheater having chambers in heat-transferring relation, one of which is included in said loop, the other having a conduit connection with the working steam-generator and an outlet for connection with a translating apparatus.

4. In a superheating system, generators for supplying working and superheating steam respectively, a conduit connection between the two containing an automatic release-valve opening toward the working steam-generator, and a superheater having chambers in heat-transferring relation and in conduit connection with the respective generators.

5. In a superheating system, two steam-generators for supplying high-pressure and low-pressure steam respectively and having releasing-valve mechanisms set to release at different pressures in the two generators, eduction-pipes leading from the respective generators, and a superheating device having passages in heat-transferring relation connected with the respective eduction-pipes.

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

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Witnesses:

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