

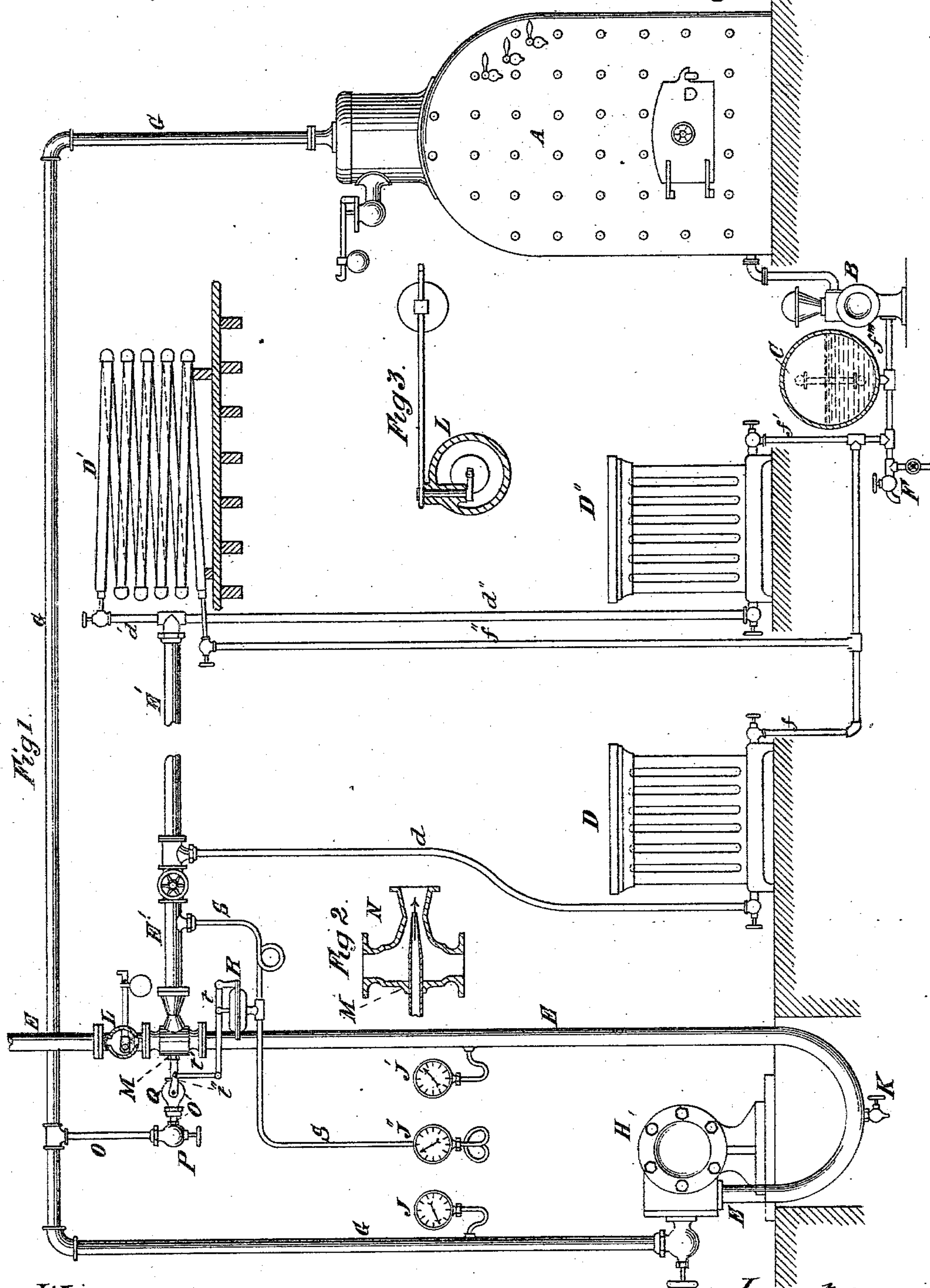
(No Model.)

F. TUDOR.

APPARATUS FOR HEATING BY EXHAUST STEAM.

No. 283,537.

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APPARATUS FOR HEATING BY EXHAUST-STEAM.

SPECIFICATION forming part of Letters Patent No. 283,537, dated August 21, 1883.

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To all whom it may concern:

Be it known that I, FREDERIC TUDOR, of Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Apparatus for Heating by Exhaust-Steam; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification.

I am aware that sundry attempts have been made to utilize exhaust-steam for motive power and to remove "back-pressure" from the exhaust side of the pistons of steam-engines. My invention, however, relates to heating apparatus supplied by exhaust-steam from the steam-engine, which exhaust requires to be delivered into the heating system under some positive pressure, and this pressure, in such apparatus as heretofore organized, reacts upon the engine-piston, and thus subjects it to considerable resistance or back-pressure, which greatly detracts from the full power of the engine; and I am not aware that any attempt has been heretofore made to relieve the engine of such back-pressure and yet maintain an effective pressure in the system of heaters by means such as I here describe. A pressure of from five (5) to ten (10) pounds is required in ordinary steam-heating systems of pipes and radiators to maintain a sufficiently-effective circulation of the steam, and it is obvious that when this pressure is allowed to react on the piston of a steam-engine it reduces by a large percentage the mean effective pressure and motor efficiency of a steam-engine, either when working under a moderate pressure with a late cut-off, a higher pressure and an earlier cut-off, or when steam is allowed to follow the piston through the entire stroke. The loss of efficiency from this cause is, however, largest in cut-off engines, and it is the object of my invention to obviate this loss.

The invention consists, partly, in the combination, with the exhaust-pipe of a steam-engine which delivers steam into a system of heating-pipes, radiators, &c., of a steam inspirator or injector attached to and in connection with the exhaust-pipe of the engine, between the exhaust-port of the engine and the

principal part of the system of heating-pipes, radiators, &c., which inspirator or injector delivers a jet of live steam from the boiler or steam-pipe into the exhaust-pipe in a direction toward such system, and by its eductive action reduces the pressure between it and such exhaust-port and maintains a pressure in the heating system into which it discharges.

The invention also consists in certain details of arrangement and construction herein set forth.

Figure 1 in the drawings represents a partial section and partial elevation of a boiler, engine, and their attachments, and a system of pipes, radiators, &c., with their attachments, constructed to carry out and illustrate my invention. Figs. 2 and 3 represent details.

A represents a boiler, with the usual attachments, including feed-pump B, which takes its water from a receptacle, C, which receives from the heating system of pipes, &c., the entire water of condensation, to be returned by the pump B to the boiler A.

D D' D'' are radiators connected by pipes d d' d'' with the exhaust-pipe E E', and with the receptacle C, and with the pump B, and it is provided at F with a valve for discharging the contents of the receptacle C and draining the pump when necessary.

G is the induction-pipe leading from the boiler A to the engine H. The induction-pipe G and the branches E E' of the exhaust-pipe are each provided with a gage, (represented at J J' J'') for denoting the respective pressures in said pipes. The exhaust-pipe is also provided at any convenient part with a drain-cock, K. A weighted lever-valve, L, allows steam to escape from the branch E of the exhaust-pipe whenever the pressure rises therein above the proper point, and this escape gives warning to the attendant that the apparatus is not working properly, this branch of the exhaust-pipe being the part from which the pressure is removed when the parts of the apparatus yet to be described are in working order. The branches E and E' of the exhaust-pipe are connected, preferably at a right angle, with each other, and at their junction is placed an inspirator or injector, M. (Shown partly in section in Fig. 2.) The nozzle N of

this inspirator or injector is inserted into the branch E of the exhaust-pipe in such manner as to deliver its stream toward the system of pipes, radiators, &c., which constitutes the heating system, and in a direction away from the exhaust-port of the steam-engine.

Live steam is conveyed to the inspirator or injector M by a branch pipe, O O', from the induction-pipe G. A drain cock or valve is attached to O O' at P to keep this pipe free from accumulated water or other obstruction. At any convenient part of the pipe O O' there is placed an automatic cock or valve, Q, for regulating the flow of live steam to the inspirator. Various means may be employed to cause this valve to act automatically, and I do not confine myself to any particular one.

In the example of my improvement shown in the drawings I use an ordinary diaphragm-regulator, R, for controlling the valve Q. Steam from any point between the inspirator and the radiators is brought under the diaphragm in R by connecting the lower part of R with a pipe, S, which may also lead to and connect with the pressure-gage attached to E'. The diaphragm is connected with the valve O by link and lever mechanism *t t' t''* in the ordinary well-known manner of constructing such mechanism, and when the pressure falls in E' such mechanism opens the valve Q farther to increase the jet of steam through M into said pipe, and vice versa.

It may now be seen that by the means described, when the engine is in action and the steam-jet *m'* is emitted at the proper force, the exhaust-steam will be rapidly educted from the engine by the powerful eductive action of the steam-jet, and the mixture of this exhaust from the engine and the live steam from the jet will be forcibly injected into the system of heating-pipes and radiators. In this way an effective pressure—say five pounds per square inch, or more—will be maintained in the heating system, and at the same time all back-pressure will be removed from the exhaust-pipe E, thus greatly increasing the efficiency of the engine and enabling it to work up to its full power. Not only will the steam-jet thus remove the back-pressure from the exhaust of the engine, but, in addition to this, it will in most cases actually form a vacuum or partial vacuum in the exhaust-pipe, which will greatly assist the working of the engine and increase its power in a positive

manner in proportion to the degree of vacuum effected; hence, while the power of the engine is increased both in a negative and positive manner by this improvement and a system of heaters is maintained by the same means, yet the amount of steam used to sustain the jet need be little or no greater than that used through the engine when the exhaust is directly delivered under pressure into the heating system, and hence, while the consumption of steam is the same, the power of the engine is greatly increased, and the heating effect in the heating system is also increased, for, as a large portion of the steam forced into the heating system is live steam, it thus contains much more heat than would be the case if it were all at first passed through the engine, where its expansion would remove a great portion of its heat, so that by these means a great improvement is effected, both in the working of the engine and in the action of the heaters, without increased cost.

What I claim is—

1. In a heating system for using exhaust-steam for heating purposes, the combination, with the exhaust-pipe of the steam-engine and a system of heating-pipes, radiators, &c., supplied with steam from the exhaust, of a steam inspirator or injector placed in relation with the exhaust-pipes, heating-pipes, radiators, &c., as set forth, and operating substantially as and for the purpose herein described.

2. The combination, in a steam-heating system, of an exhaust-pipe, an inspirator or injector, a system of pipes, radiators, &c., and an automatic valve for regulating the injection of steam through said inspirator, substantially as and for the purpose specified.

3. The combination, in a system for heating by exhaust-steam from a steam-engine, of an exhaust-pipe delivering steam from the engine to and into the heating system, a steam injector or inspirator for removing pressure from the exhaust-pipe between the injector and the engine and accumulating or maintaining pressure in said system, and a relief and alarm valve for permitting escape of steam from the part of the exhaust-pipe between the inspirator or injector and the engine, substantially as and for the purpose specified.

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Witnesses:

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