W. Mont. Storm,

Steam-Boiler Superheater.

No. 12,355. Patented Feb. 6, 1855.

Fig. 1

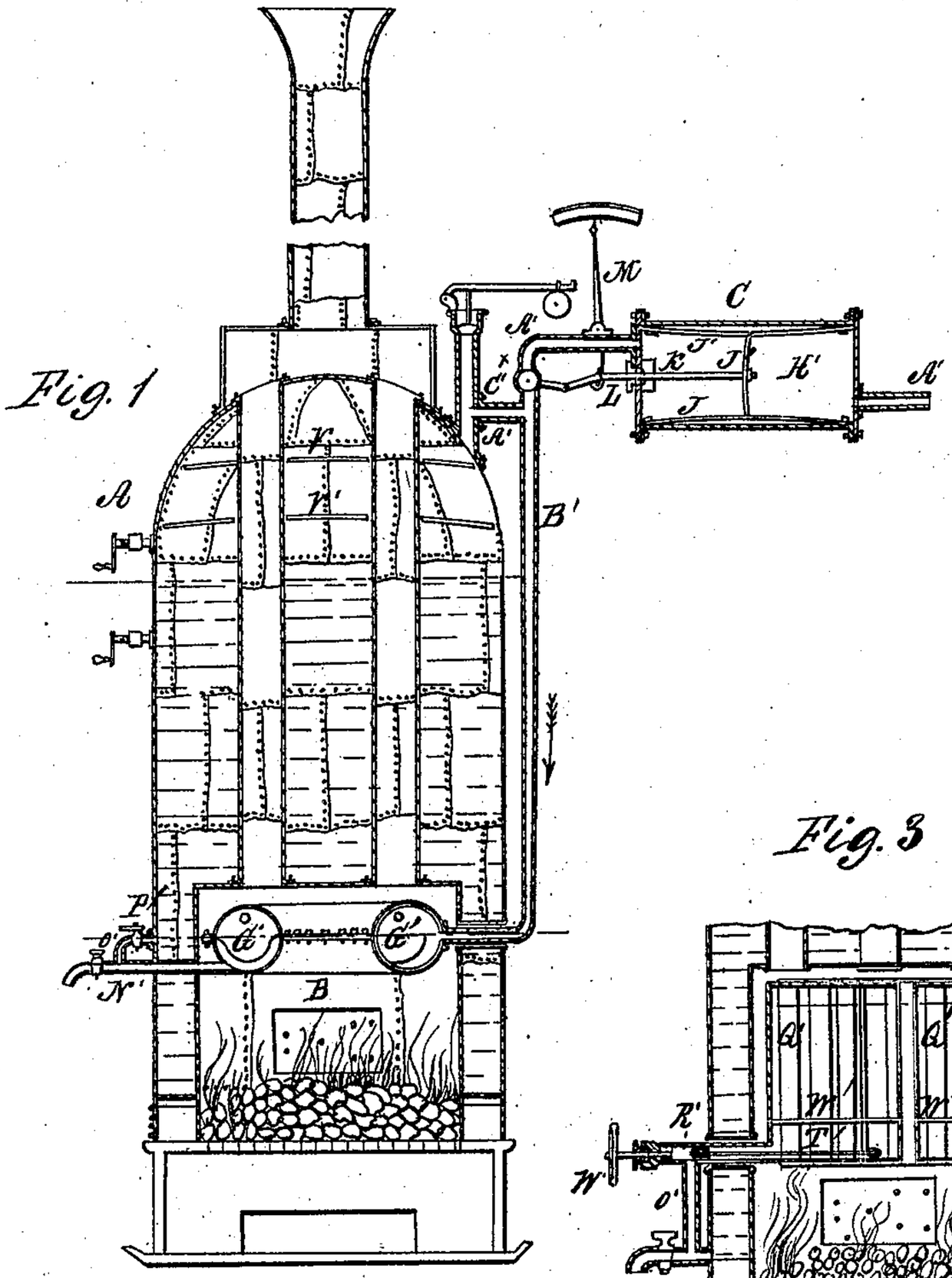


Fig. 3

Fig. 2

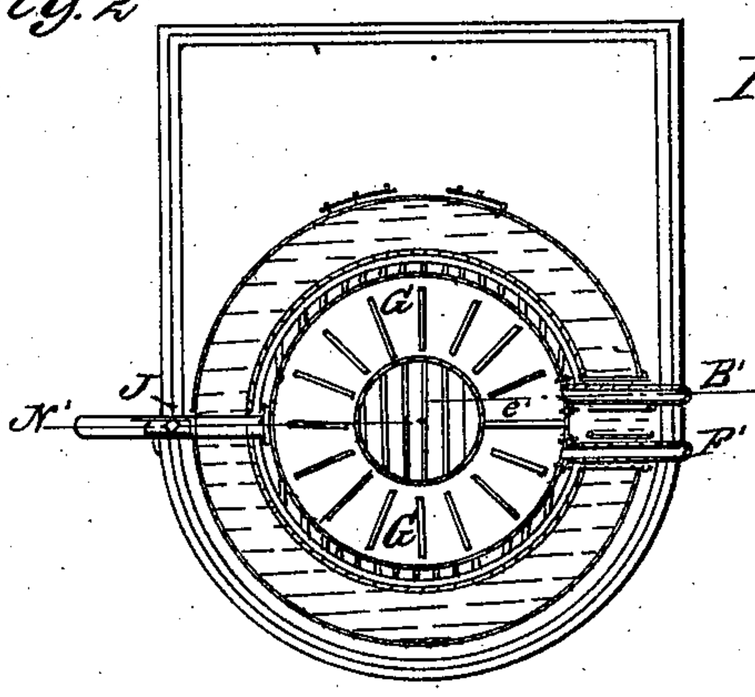
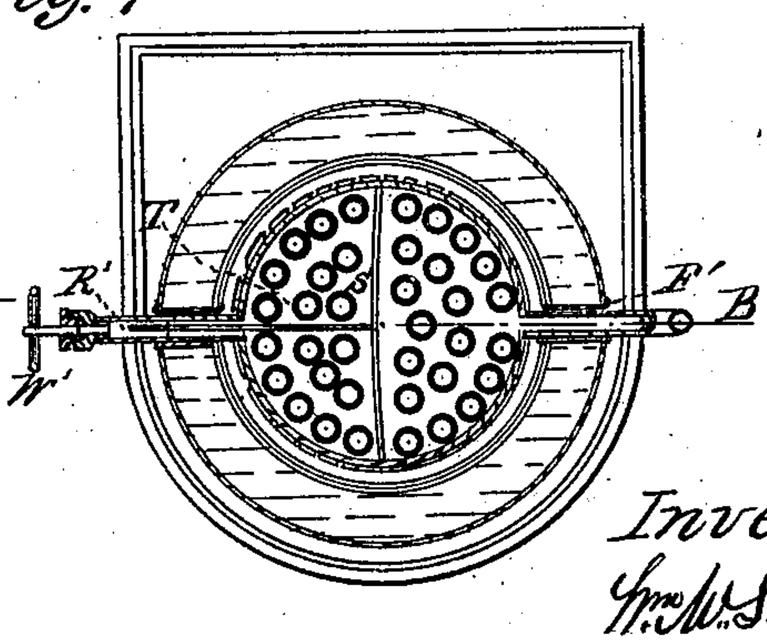


Fig. 4



Inventor,
Wm. M. Storm

UNITED STATES PATENT OFFICE.

WILLIAM MT. STORM, OF NEW YORK, N. Y.

IMPROVEMENT IN STEAM-GENERATORS.

Specification forming part of Letters Patent No. **12,355**, dated February 6, 1855.

To all whom it may concern:

Be it known that I, WILLIAM MT. STORM, of the city and State of New York, have invented an Improved and Useful Method of Generating Anhydrous Steam, of which the following specification, elucidated by the accompanying drawings, embraces, I believe, a full and fair description of all the more essential features.

The value of anhydrous steam in an economical point of view is well known to those skilled in such matters. The amount of water carried off in suspension in common steam, taken as usually found employed, and conducted direct to the engine is so considerable that if such steam were simply rendered anhydrous by the further application of heat, even without superheating, it would frequently be found to have doubled in volume. This I have tested long since. Further, it must be considered that the water so carried off is at the maximum temperature—that of the steam containing it—and all this heat is not only wasted to a great extent, but this water becomes a tax upon the steam with which it is admixed in the following manner: Having been heated under the maximum pressure of the steam, which is its vehicle, as that steam expands behind a piston, and so becomes of less pressure, the exterior of each globule of this suspended water flashes into steam according as the restraining pressure is less, (as is well known,) leaving the remainder by the absorption of its heat into a "latent" form much cooler than the surrounding steam, which must (some of it) now condense by yielding heat to restore the necessary balance of temperature. To this is due mainly the loss of power during "priming," so well known to engine-men, and water carried off in suspension is only priming in a minor degree. Again, this water is in a state the most advantageous possible for being by proper management quickly transformed into perfect steam, because by its minute subdivision it exposes an immense surface to the heat, especially radiated heat, emanating from any source of heat brought to act on it. Now, although these advantages and disadvantages are pretty frequently known to engineers, the present well-known method of forming anhydrous steam has defects so great in practice as to preclude its frequent employment, consisting substantially and merely in conducting the steam prior to its advent at the engine to another vessel distinct from the boiler and exposed to the action of the fire or hot draft, and to which vessel no water has any means of access but such as enters with the steam, the latter passing from this superheating vessel direct to the engine.

The defects are that, although there is no difficulty in superheating the steam to any extent, according to the size of the superheating-vessel and the part of the fire-space in which it is located, yet, as too great an excess of heat would cause the destruction of any ordinary packing by charring if non-metallic, and by destroying the temper and spring of metal rings, and also injure valves by warping, &c., and internal wearing-surfaces by preventing moisture or unctious lubrication, the superheating-vessel must therefore be located by guess where it will average the proper temperature under the influence of the average fire, and then it is not possible to maintain properly this average by the immediate and sole agency and under the influence of a fluctuating fire—at one time glowing, at another covered with fresh fuel; at one time with a strong draft, at another with a weak, damp, or cold one—so that an excess of superheat, with its attendant evils, is constantly liable to occur on the one side or a deficiency of heat, and to that extent a loss of economy and attainable effect, on the other. Neither could the desired average of heat and dryness of the steam be maintained even though the fire were constant, as the moisture in the steam (and therefore the intensity or duration of the heat to which it would require to be subjected) varies with the varying pressure, height of water in the boiler, rapidity of its exit, &c. Another great defect in the methods heretofore employed is that when the engine is not in motion and during the getting up of steam prior to starting no steam, with its attendant moisture, is passing through the superheating-vessel to protect it from being "burned out" and becoming weak and dangerous, and consequently it never lasts long in comparison with the rest of a boiler,

in consequence of which superheaters are usually looked on in the character of temporary additions or fixtures, rather than a legitimate and standard part of a steam-generator.

Now, my invention claims to remove these faults and uncertainties on the one hand and embrace all the desired advantages on the other—first, by embracing means for regulating the heat and moisture of the steam supplied to the engine in a ready and adjustable way, independent and beyond the control of the fire, &c.; secondly, by providing simple and effective means for rendering the first-mentioned means or device self-acting and the temperature of the steam passing to the engine self regulating and adjusting, as much as now the force of the steam passing to an engine is self-regulating through the agency of the throttle-valve and "governor;" thirdly, in so locating and adapting my superheating-vessel or "desiccator" (whichever it may most properly be termed) that it may not only be protected while the engine is at rest from burning out, but become at such time itself a regular steam-generator—in fact, the most efficient part of the boiler. These constitute the three main or principal features of my invention, although it embraces other minor, though valuable, improvements, that will be described in due course.

I will now proceed to give a more specific description, reference being had to the accompanying drawings, like letters upon which in all cases indicate like parts.

A, Figure 1, represents an upright tubular boiler in section, (any other form of boiler may be employed, however,) in the fire-space of which I locate a strong iron vessel, B, which is the superheater or desiccator. A series of these of any form may be employed, if desired—as, for instance, a series of cast-iron globes, of moderate dimensions and so connected by a communication-tube from one to another as to act in conjunction, may be used. The extent of the superheating means or vessel I deem should be such that, say, three-fourths of the steam from the boiler may be superheated to about 500° Fahrenheit. Now, by the usual method, where a superheater has been employed, the steam has no means of access to the engine except through and from the superheater, whereas I employ a steam pipe or conduit leading from the boiler to the engine direct, as A′ A′, and from this a branch to the superheater, as B′, and thence back again to the direct or general conduit, there being between the points of its departure and return (the latter shown at *x* on drawings) a regulating or throttle cock, C′, and, supposing the latter closed, the whole of the steam will pass through the superheater, and if the cock is full open, the steam being equally free to pass either through the superheater or through the direct conduit to the engine, the main portion will take the shorter course, so that the remainder, which joins it from the superheater, will not by its excess of temperature bring with it a sufficient quantity of heat to convert all the moisture in the first and principal portion into steam, letting alone superheating it, and consequently mere unsuperheated or simple steam will reach the engine. Any midway position of the cock would of course produce a proportionately-modified effect between these two extremes upon the steam that reached the engine, as will be evident upon inspection.

Fig. 2 is a horizontal section through the fire-box and water-leg of the boiler and through the desiccator. The steam entering by B′ is obliged, because of the partition E′, to pass entirely around and through the desiccator before reaching the exit-pipe F′. G′ are deflectors attached to the upper inner surface of the desiccator to oblige the steam to circulate against the lower and hotter surface. They also act as recipients and radiators, diffusing and equalizing the heat to a considerable extent. F′ rises from the superheater up alongside of B′ and delivers into the main pipe or direct conduit A′ (conveying the unchanged steam) at *x*, as before mentioned, the simple and superheated portions of steam being thus admixed, and the excess of moisture on the one side and of temperature on the other being mutually counteracted, the relative proportions of simple and superheated steam being governed to that end by the adjustment of the cock C′. Now, that this adjustment may be retained as near as may be at the point of maximum advantage under the various fluctuations of temperature, moisture, &c., in the steam, I have devised the thermometric "regulator" C, which is made to become a portion of the main conduit supplying steam to the engine, and consists of a rectangular flat case of iron, H′, made steam-tight and containing two zinc or composition straps or bars, I′, riveted at their extremities to the box and at their middles to the opposite ends of the connecting ("toggle") strap I′. Now, the heat of the steam expands these bars faster by about threefold than it does the iron case, and their ends being confined the expansion causes the middle of the bars to be sprung inward a distance manifold greater than the longitudinal extension would be even if allowed. This expansion is multiplied upon the center or connecting strap in a similar manner. This strap or toggle connects to and moves the rod K′, which, passing through the stuffing-box L′, connects in turn to the end of the indicator-needle M′, and also by an intervening link, as shown, to the handle of the regulating-cock C′. Thus it will be seen that if the steam passing through the regulator to the engine falls below the temperature which the former is "set" to retain the contraction of the expansion-bars by moving cock C′ in the proper direction (see drawings) will throttle and cause a larger proportion of the direct or pri-

mary current of steam to flow through the desiccator, and vice versa, thus maintaining or restoring the proper temperature.

Now, the means I employ to protect the desiccator from burning while no wet steam is passing through it, as when steam is being "raised," the engine at rest, &c., and to the end that it may during like occasions be employed directly in generating steam—in other words, become an actual part of the steam-boiler proper—are as follows: From the bottom of the desiccator (see drawings) I have a pipe to be used occasionally as a "blow-through" pipe for cleansing the desiccator of sediment, and this pipe (marked N′, Fig. 1) coming to the outside of the boiler has a branch or communication pipe, O′, leading to the water-space of the boiler. Now, by partially opening the cock P′ in this pipe when the desiccator is likely to become overheated it will be obvious the water from the boiler will little by little or suddenly and in a stream flow through these pipes into the desiccator, according to the extent to which the cock P′ is open, and, forming steam, will take up any excess of heat beyond that due to the pressure of the steam if the supply of water allowed to enter is sufficient; but, if limited, any desired excess of heat or superheat may be retained. If the desiccator was allowed to fill, the water could not rise above the level of the pipe B′ where it enters the desiccator, for if it should the steam formed in the latter, being confined, would promptly become of greater pressure than that in the boiler and press the water out till it could itself escape by B′ to the main steam-dome. These different arrangements, as described, may be considered as attached to a boiler previously built without reference to them; but where, on the contrary, their attachment was anticipated I should build the boiler with an extra height of fire-space, as Fig. 3, and in lieu of a vessel such as B I would use a cylindrical vessel with tubular flues, as Q′, Fig. 3, to which the steam would all come direct from the steam-dome through B′ and from the desiccator through F′ direct to the engine, and then to protect the desiccator and control the superheat I do as follows: The pipe equivalent to O′, before named, instead of being intercepted by a hand-cock is intercepted by a plunger, R′, which, as the equivalent of P′, Fig. 1, fits the pipe leading into the desiccator, and which should be of brass, as should also the pipe be, and smoothly bored. Now, on inspection it will be seen that if the plunger R′ is pushed outward (to the left on the drawings) it will uncover the passage and allow water to enter the desiccator in amount corresponding to the distance outward the plunger is moved, thus increasing the opening, and vice versa. Now, to regulate the movement and position of this plunger (and so the heat in the desiccator on the principle before explained) I so locate and arrange C, or its equivalent, (inside of the desiccator itself, for instance,) that it shall regulate the plunger as, in the instance shown in Fig. 1, it does the cock C′. The application of a single "expansion-bar," S′, running across the desiccator a little above its bottom, and passing through and secured to its shell, is in this case sufficient, the expansion-bar being so confined that it shall always have a curved form, so that the direction of its motion upon being heated shall always be determined. From the middle of the bar runs a copper or brass rod, T′, to connect with and move the plunger, and at what point (of expansion, and so of temperature) the plunger leaves O′ open may be regulated by screwing the plunger farther in or out upon the rod T′ through the agency of the wheel U′, whose stem passes through a stuffing-box, as seen, and is solidly fixed to the plunger.

Of course C and its appurtenances, as shown in Fig. 1, are all dispensed with, and the whole is shown in Fig. 3 in a simple, effective, and self-acting form.

Diaphragms V′, Fig. 1, extending across the steam-space and through which the flues pass, leaving an annular opening all around each at that point, greatly aid not only in deflecting particles of water rising with the steam, as in priming, back to the main body of water below, but the steam in passing is thus all obliged to "lick" the heated flue, and so be rendered more anhydrous. I place a similar diaphragm in the desiccator at W′ for a similar purpose. As in a boiler so arranged priming would be rather an advantage than otherwise, (provided the means of desiccating the steam were correspondingly ample,) inasmuch as the water carried over in so divided a state is so easily converted into steam, as hereinbefore explained, I have anticipated connecting with the boiler an air-pump to be driven by the engine. This would cause a plentiful priming, (as has been found in the cases of a similar application by De Rosen and Hall and Bennett,) and, practically speaking, no other effect, and a pump of very moderate dimensions is surficient. I have also anticipated the location of the desiccator in a chamber left within the body of the boiler, the fire thus passing through a lower tier of flues before reaching the desiccator.

Having now fully described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. Inclosing a thermostat in a steam-tight space forming a part of the steam-conducting passage to the engine, and from such thermostat forming an exterior and adjustable connection to a cock or valve, as C′, located in the exit-pipe of the boiler in such manner that, being moved by the thermostat, it shall direct more or less of the steam through the superheater, the whole device by acting in conjunction thus controlling while

being actuated by the temperature of the steam going to the engine.

2. Regulating and tempering the heat in the desiccator by the admission to it as may be necessary of water from the boiler by means of an especial communication, as pipe O′, the quantity admitted being governable by the adjustment of a cock, as P′, all substantially as explained.

WM. MT. STORM.

Witnesses:
CHAS. F. HITCHING,
THOMAS H. KING.