Specification of James Rumsey : boilers for steam engines, for distillation, &c.;

A.D. 1788 . . . . . N° 1673.

SPECIFICATION

OF

JAMES RUMSEY.

BOILERS FOR STEAM ENGINES, FOR DISTILLATION, &c.

LONDON:
PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,
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Price 11*d.*
1854.

A.D. 1788 . . . . . N° 1673.

Boilers for Steam Engines, for Distillation, &c.

RUMSEY'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, JAMES RUMSEY, send greeting.

WHEREAS His most Excellent Majesty King George the Third, did, by his Letters Patent under the Great Seal of Great Britain, bearing date at Westminster, the Sixth day of November, in the twenty-ninth year of His reign, give and grant unto me, the said James Rumsey, His especial license, full power, sole privilege and authority, during the term of years therein expressed, to make, use, exercise, and vend, within that part of Great Britain called England, the Dominion of Wales, and Town of Berwick upon Tweed, my Invention of "CERTAIN NEW METHODS OF CONSTRUCTING BOILERS FOR DISTILLATION AND OTHER OBJECTS, AND FOR STEAM ENGINES FOR VARIOUS PURPOSES;" in which said Letters Patent there is contained a proviso or condition obliging me, the said James Rumsey, by an instrument of writing under my hand and seal, particularly to describe and ascertain the nature of my said Invention, and in what manner the same is to be performed, and to cause the same to be inrolled in His Majesty's High Court of Chancery within one month after the date of the said Letters Patent, as in and by the same, relation being thereunto had, may more fully and at large appear.

NOW KNOW YE, that in pursuance of and compliance with the said proviso or condition, I, the said James Rumsey, do hereby declare that the nature of my said Invention, and the manner in which the same is to be performed, are herein-after particularly described and ascertained (that is to say):—

My certain new methods of constructing boilers for distillation and other objects, and for steam engines for various purposes, consist of the following principles:—

First, in forming my boilers either of partitions or subdivisions of larger vessels, or of combinations of smaller ones, or of cylinders, tubes, cavities, perforations, or projections of homogeneous or varying forms, or of one or more of these varieties, constructed so as to favor the heat and action of the fire throughout the greatest possible extent of the surface against which the fluid, steam, or vapour to be heated rests. Secondly, in employing the steam or vapour which arises within my boilers or stills, or any detached parts of them, to act powerfully within, against, or upon one or more of the vessels which form them, or are connected with them, or with any of their detached parts, so as to give forcible motion to several machines in the manner herein-after specified. Those vessels (or parts of my boilers or stills) in which the steam or vapor exert their force I shall hereafter distinguish by calling them receivers. Thirdly, in employing the heated air and smoak after it has been applied to the boiler to warm the vapor or fluids intended to be evaporated previous to their entering the boiler. Fourthly, in causing air, flame, or smoak of the fire to pass immediately through the body of steam or of the fluids intended to be heated or evaporated, these bodies being afterwards separable, principally by means of their having different specific gravities. Fifthly, in some cases (either mediately or immediately) by evaporating one fluid by heating it with or passing it through another, or through any substances (as wax, rossinous bodies, or lead) brought into a fluid state. Sixthly, in connecting the receivers of my stills or boilers with common stills, and causing the vapor rising from them to act upon vessels moveable within the receivers, with such power as to give or assist in giving motion to sugar mills, or to raise water, grind grain, or any other necessary purposes, after which the vapor passes into the still worm, and is condensed as usual without receiving damage or waste. As the vessels moving within the receivers of my stills or boilers perform the office of pistons, I shall therefore hereafter call them hollow pistons. Seventhly, where evaporation alone is the principal object, as in making salt, and separating fresh from salt water, and in other cases, by applying the heat of the sun or of a small fire to the vessels, stills, or boilers containing the substance to be acted upon after they have been exhausted, as circumstances may require, in part or altogether of air. Eighthly, in many cases by applying my new constructed boiler or still to raise water by interposing an air vessel between the forcing power and the tube which conveys away the water raised, that the air being compressed in the air vessel may keep the current of the water rising through the tube in a constant and almost regular motion, and thereby save a great loss of power necessary to put that column of water into motion every time it comes into a state of rest, and also in fixing my valves which have to sustain great weight upon spiral or other formed springs, which

will prevent them from wearing or shocking the vessels which contain them when shut^{e}, and likewise enable them, in some degree, in some cases to act like the air vessel here mentioned. As my boilers, steam vessels, or stills may be infinitely varied in their forms and applications, it is impossible to give Drawings of them all, but those that follow will sufficiently explain the nature of the principles I have laid down.

Fig. 1 represents a boiler composed of tubes, the open ends of which are inserted into the upright side of a metal box. It is to be surrounded with a case of a somewhat larger size, seen at Fig. 2. The fluid or vapor is heated both in the tubes and between the box and its case. The fire-place is within the box, and its flame, &c. presses round the tubes, but so as that its course tends first upwards by means of a partition within the box lying parallel to the dotted line C, and then downwards on the other side of the partition at C to get at the passage to the chimney of Fig. 2, placed at the bottom. Fig. 3 represents tubes and other inclosures for fluid and vapor. The tubes do not reach entirely through this vessel, as in the preceding instance, but point towards the fire from each side, and stop on each side at the fire, being closed at that part towards the fire, though open outwards, as in the preceding instance. There is a similar outward case to the whole, as in Fig. 2, for a similar purpose. Fig. 4 represents one of the two plates to be inserted within the vessel at Fig. 3 on each side of its fire-place B. The flat prongs of these plates, passing at right angles into the hollows of the upper inclosures (which are white in the Drawing) fit the hollows closely except at the tops, by which means the heat, &c. rises upright in the middle, but descends to the right and left over the tops of the flat prongs, and when descended goes by a passage to the chimney, as in the former instance. The black parts seen laterally in Fig. 3 contain fluid and steam. The lower parts of the plates represented at Fig. 4 may or may not have perforations for the heat to get at the tubes. In both the preceding cases the chimney is made with a double flue, between which fluid to feed the boiler descends to obtain a previous heat. It is needless to shew how the vapor is drawn off. A, B, (Fig. 5,) is the section of an outside case to another boiler; the fire is enclosed at C, D, and sends its heat through tubes, the open ends of which are fastened into places at E and G. The interstices of the tubes are filled with fluid which communicates with other fluid in the outside case, as in the preceding instances. The tube and cap H and F being let down to close upon the plate E, causes the smoak to rise through the flue H; the fluid floods over the cap, but does not ascend to the top of the outside case A, B, a part of its vault being left for vapour. A, B, (Fig. 6,) is another section of an outside case, and E and E are each respectively double plated cylinders, which stop

at F; and in the hollows inclosed between these plates respectively tubes are inserted, which communicating with the flame conducts it down into the receptacle F, being the channel of communication with H, which acts as a chimney. The fluid both surrounds and lies within the cylinders E, E, from which and from the fire-place C, D, and chimney H, it and its vapor receives heat. Fig. 7 represents a fire-place C, D, which sends its heat, &c. through the spiral tube I, H, the fluid and vapor lying without these and within the outer case A, B, the vapor or steam being occasionally let down through the pipe K into the receiver E, E, to work a hollow piston within it, the application of which and manner of its working is fully explained by Fig. 13. By covering the receiver of this boiler and various others herein described, or that may be formed on the same principle, they become stills, and that a still and boiler for a steam engine may become one and the same thing in practice, and perform the offices of the three.

Fig. 8 has a fire-place at O, the heat of which, &c. acts upon the bottom of the receiver E and cylinder F, and spreads through the case C, D, and round the spiral tube I, K, the ends of which are inserted into C, D, and the fluid in it communicates with that between the case A, B, and C, D, and also with that which lies between the receiver E, and cylinder F. M, M, are iron studds (several of which are not seen) which support the receiver and its connections by its strong metal bottom L. Fig. 13 also represents the machinery of the receiver E of this Figure.

A, B, (Fig. 9,) represents a boiler, consisting of a simple tube, bent as represented in the Figure, crossing at right angles (as often as may be found necessary for the purpose intended), forming cavities like a bottle case in which the fuel is burnt. It is clampt at the corners to keep it in form; this boiler is fed at A by a smalling forcing pump or other power, and the steam to be employed will issue out at B; the pipe C, with its safety valve D, joins the boiler near B, and is then in a perpendicular direction. It is needless to multiply the various shapes that depend upon the singular principle of this pipe or tube boiler. This boiler may be set up in brickwork or may be enclosed in a double metal case, containing a sheet of water between.

Fig. 10, A is here the fire-place, the heat of which, &c. passes through the tubes and cavities respectively marked by the letters B, B, C, D, D, E, F, F, G, and K. The fluid or vapor surrounds these tubes or cavities, or lies between them, having an uninterrupted communication in all its parts. I call this the watch chrystal boiler, because metal plates of that form (having a perforation in their centers and where the tubes pass) are reserved with their concavities and convexities coming alternately together, forming hollows

for the heat, &c. to ascend through to the flue K. The machinery either of Fig. 11 or 12 may be fixed upon Fig. 10 at K, L, through which the heat, &c. takes the same course as in Fig. 10, being designed to heat (with such power as remains) the fluid which is to descend through the tube L, there to undergo a greater heat, at Fig. 10. In Fig. 12 the heat, &c. with the same vein passes through a spiral tube, and heats the fluid lying between it and the surrounding box. There is a gauge cock at L in Fig. 10 to regulate the descent of this upper fluid into the boilers; these pieces of machinery at Fig. 11 and 12, and of many other forms, or the double flues of the chimney first described, may be applied to other cases.

Fig. 13 is a section of the receiver E, E, of Fig. 7 and its connections. It will also apply to the receiver E, Fig. 8. I shall describe the mechanism of this Fig. particularly, which will answer for all the rest by being a little varied at the pleasure of the engineer, or according to the purposes to which it may be applied. A, A, is the receiver; B, B, a hollow piston, which moves in the receiver, and is made steam-tight with oakum and other substances, and is connected with the cylinder C, C, the size of which depends upon the purposes the engine is applied to. D is the piston of C, C, stationary by means of E, F, a bolt and screw holding it to G, G, a strong piece of timber; H, and I, are metal tubes fastened to the hollow piston B, B; in I is *h*, a cock to let water on the piston; K is a pipe to lead water from the cistern L for condensing the steam; M, a spring and a screw to stiffen or slacken it; N, a catch to hold down the rod O, which is connected with the valve Q and R and the lever S within the hollow piston B, B. It also joins the lever *p*, *d*, at *p*. T and D are valves through which the injected water passes, and is discharged through the pipe Y, U, the steam pipe leading from the boiler; V, the valve to admit steam into the receiver; W, a rod to open and shut V by means of the lever X and the elbow and catch *i*, *b*. *y* is a piece of wood to unlock the catch N; the piston in the Drawing is considered as rising; when it arrives at the top of the steam vessel the spring M will press on the rod O until it is held down by the catch N; by this operation the valves Q and R are opened by means of the lever S, and the valve V is at the same time shut by the lever *p*, *d*, unlocking the elbow from the catch *b*; the steam then rushing into the hollow pistons B, B, is there condensed by a jet of cold water coming through the valve R; the hollow piston B, B, then descending takes with it the cylinder C, C, to which is connected by its ears *i*, *i*, the mechanism intended to be put in motion. The injected water at this time passes through the valves T; as the wheel *g* in the end of the catch N comes down it beats against the cleet *y*, until the rod O is unlocked, when the weight of the water on the valve R causes it and the

valve Q to shut. The steam being again admitted at V by a spring or pin at *m* pressing on the lever X, which lifts the rod W, until the elbows *i* is held by the catch *b*, when the piston again ascends by the steam coming through the valve V. If the cylinder C, C, is made of half the area of the receiver A, A, the hollow piston would work with equal force both ways.

Fig. 14 represents perpendicular tubes, not exceeding twenty-eight feet in height from the surface of the water at the dotted line K. C is a strong box, with a partition in the middle of it in which are the valves D, D, and at the ends are the valves E, E. F is a cistern into which the water is to be raised. G is the receiver within the boiler, represented by dotted lines, from which the steam enters the receiver at H. The mechanism within the receiver is nearly the same as in Fig. 15, except that there is no piston at L. The tubes A and B and the cistern at F being full of water, and the receiver G full of any fluid or substance in a fluid state that is specifically lighter than water and harder to evaporate; where those are not at hand water must be used; the steam then being admitted through a valve at H the fluids in the receiver G would descend into the tube B, and as much would be moved through the valves D, D, and into the tube A, from which an equal quantity would be discharged into the cistern F; the valve at H being then shut and the steam condensed, the valves D, D, would close, and the atmosphere would force the water through the valves E, E, and up the cube B, until the receiver G was full; and the valve H would again admit steam to repeat the operation. Another method of working this machine is to shorten the tube B until the receiver G and its connections stand at the dotted lines representing it at B, or any other convenient height. Its hollow piston being loaded with a weight not exceeding that of the water in the distance it was lowered, the steam being applied as before described, a similar effect would be produced, without the necessity of applying oil, &c.

Fig. 15 is a section of a particular application to raise water with Fig. 13 reversed. The letters A, B, C, D, E, F, G, H, O, Q, R, S, T, U, V, and W, in this Drawing, represent the same parts as in Fig. 13. M, N, is an additional cylinder screwed to the receiver A, A, and the trunk or tube G, G, so as to be air and water tight. The piston L being screwed to the cylinder C, C, moves with it and the hollow piston. I represents part of a tube, which extends down to the water to be raised, its length not exceeding twenty-eight feet, and has a valve in its bottom. I, H, is part of the tube which carries off the water; K, a small tube to convey the water which may slip by the piston L into the hollow piston B, B, from which it will be discharged with the injected water. H is a small lever and weight to keep the valve T in its

place; and P is a spiral spring to support the valve D, when the hollow piston B, B, ascends; (by the steam in the receiver A, A, being condensed) the piston L obeys its motion, and causes the water to rise through the tube I, into the cylinder M, N; when the hollow piston B, B, gets to the top of the receiver the valves Q and R are shut, and the steam is admitted through the valve V to press upon the hollow piston B, B, which causes it and the piston L to descend and force the water from the cylinder M, N, through the valve *o*, and up the tube I, H. The sizes of A, A, and M, N, may be varied so with respect to each other that the water may be raised to any height necessary.

Fig. 16 represents a wheel moving on a horizontal axis with hollow pivots; on the circumference of the wheel is wound a spiral tube, as A, B, C, D, E, and returns from E to A in the direction of the dotted lines. There is a valve at A and E which allows a body to move in the tube in one direction only; a proper quantity of fluid or any substance in a fluid state being put into this tube, and the steam being admitted between the fluid and the valves, forces the fluid in the tube up one side of the wheel, the weight of which and the reaction of the steam on the valves successively keep the wheel in motion; the cock F and the pipe connected with it admits steam into the tubes from a boiler revolving in the axis of the wheel, represented by the dotted lines, or through the hollow pivot H from a fixed boiler; when the steam has performed its office it is condensed by turning of the cock F to admit a jet of cold water through the hollow pivot G; there must be another cock with similar pipes (which are not shewn here) to admit steam into the tube at E. The cocks can be turned at the proper times by their handles being stopt by moveable pins which are turned before them by the motion of the wheel. A, A, (Fig. 17,) is a section of a boiler or still, consisting simply of the receiver and fire-place represented in Fig. 7; B is the fire-place; C, the piston, and D, a valve within it; E, a bolt connected with the machine to be worked and the piston, made air-tight where it passes through the lid I, I; the fluid lies round the fire-place B, and fills the receiver up to F; the vapour arising from the fluid at F pushes up the piston to the pipe A, which joins the still worm, and has a valve in it; the valve D is then opened, and the valve in A is shut; the piston then descends by its vapor, and the vapor below it passes through the valve D; when the piston gets down D is shut, and the valve in A is opened; the vapor then above the piston enters the still worm, and is there condensed, when the piston will again ascend with great force. This boiler would perform the office of a steam engine by introducing into it the mechanism of Fig. 13, with but little variation. Fig. 18, A, B, represents a boat and machinery which I give motion by applying one of my boilers and its connections directly, or by a lever to move the piece C up

and down forcibly. The wheels E and F, which are connected, are turned backward and forward by the motion of the piece C. By this operation the ropes or chains represented by the dotted lines from their connection with the wheel E, moves backward and forward; the box G, H, (in which is a valve at G,) and the carriage I, which moves in grooves, and has friction wheels, the boxes drawn forward with little resistance by the valve of G opening, but when it is drawn towards the stern of the boat, the water inclosed within it by the shutting of the valve prevents the box from moving back by its weight, whilst the boat is drawn forward by the ropes connected with the wheel E; these ropes move round sheaves in the pieces of timber K, L. The carriage I has poles connected with it which hang on swivels, and act upon the bottom in shallow water; there is a mortice through the boat for the poles to work in; they may be fixed between two boats connected by a platform, or may be worked on both sides of the boat by a piece of timber crossing it, and connected with the carriage I. Fig. 19, the section of a boat, with A, B, a trunk in its bottom, which has a valve C and D communicating with the water that floats her. M and N is a cylinder screwed on the trunk A, B, and has its piston L connected with the bolt I, to which I apply one of my boilers or stills with their connections directly, or by a lever to move the piston L up and down with great force, by which means water is drawn through the valve C and trunk A, B, and is discharged through the valve D which causes the boat to move forward. To Fig. 20 and 21 I apply the power of steam nearly in the same manner as in Fig. 19, the only difference between them being in the number of valves in their trunks, and the situation of their cylinders or forcing pumps, which are the most material things to be attended to, for the nearer they are to the head of the boat the more valves are necessary, and the greater should be the descending power of the forcing pistons, in proportion to which the ascending motion ought to be weakened; when the cylinder is fixed in the middle of the boat (as in Fig. 20), the rising and sinking power ought to be equal. There is a small advantage in admitting air into the trunk by valve near the cylinder or forcing pump when they are fixed near the foremost end of the trunk. To give motion and an axis I fix upon it a ratch and pinion wheel connected as in Fig. 22; the box of iron A, B, goes through, or is immoveable on the axis to be turned, and has fixed to it the catches C and D, to prevent the ratch wheel from turning one way but not the other; the frame E, F, G, H, with cogs in both sides which point in contrary directions those in H, enter the pinion wheel shown in the Fig., another such wheel and its connections being put on the same axis with the cogs in G, between its pinions. This last wheel could not turn on the axis in the same direction as the other; consequently, if a power (as steam) was applied,

to move the frame E, F, G, H, up and down, it would continue the motion of the axis in one direction only. Fig. 23 represents a method of giving motion round a perpendicular axis by means of my boiler, &c; A, B, C, D, is a frame in which the axis moves on the pivots B, D. E, F, and E, G, are spiral felloes, each winding half round the cylinders or frame H, I, to which they are made fast. K, L, is a bolt with a wheel N, fixed on its side by a studd; this bolt moves through supporters at K and L, with ease, the power being applied to one end of this bolt to cause it to descend, when the wheel N, by pressing on the spiral felloe G, E, will cause the axis to move round; when N comes down to the points of the felloes E, F, and the moving power begins to act upwards, the wheel N will push against the under side of the spiral felloe F, E, and continue its motion by its ascent; when the dotted part now seen behind turns in front, the wheel N will pass between E and G; the power again causing the bolt K, L, to descend, the wheel N will pass upon the spiral felloe G, E, and continue the motion round the axis in the same direction.

In witness whereof, I, the said James Rumsey, do hereunto set my hand and seal, this Sixth day of December, in the twenty-ninth year of the reign of our Sovereign Lord George the Third, by the grace of God of Great Britain, France, and Ireland, King, Defender of the Faith, &c. &c., in the year of our Lord One thousand seven hundred and eighty-eight.

JAMES RUMSEY. (L.S.)

Signed, sealed, delivered (being first duly stamped) in presence of

THOS LINLEY,
G. W. WEST.

AND BE IT REMEMBERED, that on the Sixth day of December, in the year of our Lord 1788, the aforesaid James Rumsey came before our said Lord the King in His Chancery, and acknowledged the Specification aforesaid, and all and everything therein contained and specified, in form above written. And also the Specification aforesaid was stampt according to the tenor of the Statutes made for that purpose.

Inrolled the Sixth day of December, in the year of our Lord One thousand seven hundred and eighty-eight.

POPHAM.

LONDON:
Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1854.

A.D. 1788. Nov 6. N° 1673.
RUMSEY'S Specification.

(1 SHEET.)

FIG. 1.

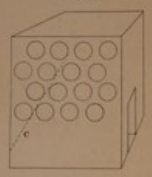


FIG. 2.

FIG. 9.

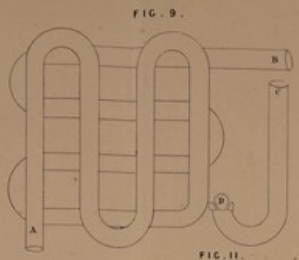


FIG. 14.

FIG. 15.

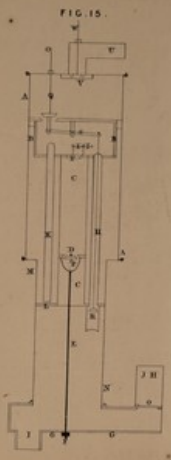


FIG. 23.

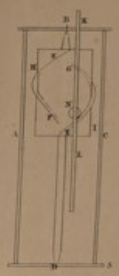


FIG. 3.

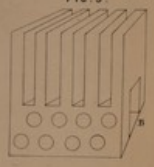


FIG. 4.

FIG. 10.

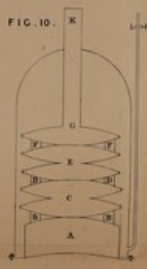


FIG. 11.

FIG. 12.

FIG. 22

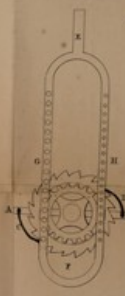


FIG. 5.

FIG. 6.

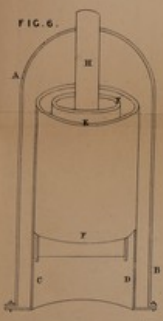


FIG. 16.

FIG. 13.

FIG. 17.

FIG. 18.

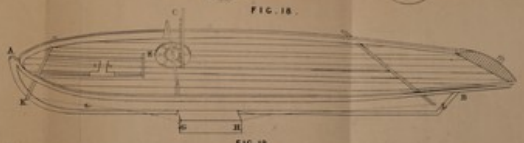


FIG. 19

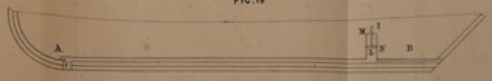


FIG. 7.

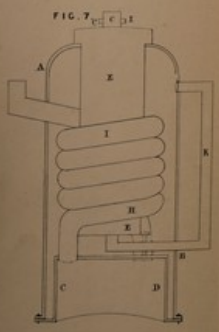


FIG. 8.

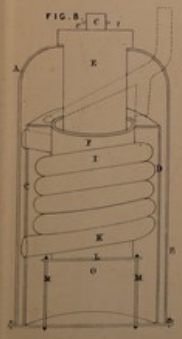


FIG. 20

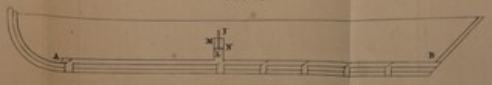
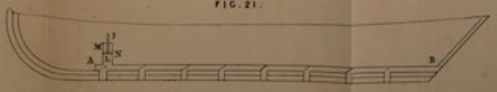


FIG. 21.



The smalled drawing is partly colored.

London: Printed by George Edward Eyre and William Spottiswoode
Printers to the Queens most Excellent Majesty. 1858