Specification of William Brunton : steam engines and furnaces.

A.D. 1819 . . . . . N° 4387.

SPECIFICATION

OF

WILLIAM BRUNTON.

STEAM ENGINES AND FURNACES.

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Steam Engines and Furnaces.

BRUNTON'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, WILLIAM BRUNTON, of Birmingham, in the County of Warwick, Engineer, send greeting.

WHEREAS His most Excellent Majesty King George the Third did, by His Letters Patent under the Great Seal of the United Kingdom of Great Britain and Ireland, bearing date at Westminster, the Twenty-ninth day of June, in the fifty-ninth year of His reign, give and grant unto me, the said William Brunton, my ex̃ors, adm̃iors, and assigns, His especial licence, full power, sole privilege and authority, that I, the said William Brunton, my ex̃ors, adm̃iors, and assigns, during the term of years therein mentioned, should and lawfully might make, use, exercise, and vend, within England, Wales, and the Town of Berwick upon Tweed, my Invention of "CERTAIN IMPROVEMENTS IN STEAM ENGINES AND FURNACES OF STEAM ENGINES, BY WHICH A SAVING IN THE CONSUMPTION OF FUEL IS EFFECTED, AND THE COMBUSTION OF THE SMOKE IS MORE COMPLEATLY ATTAINED;" in which said Letters Patent there is contained a proviso that if I, the said William Brunton, shall not particularly describe and ascertain the nature of my said Invention, and in what manner the same is to be performed, by an instrument in writing under my hand and seal, and cause the same to be inrolled in His Majesty's High Court of Chancery within six calendar months next and immediately after the date of the said Letters Patent, that then the said Letters Patent, and all liberties and advantages whatsoever thereby granted, shall utterly cease, determine, and become void, as in and by the same, relation being thereunto had, will more fully and at large appear.

NOW KNOW YE, that in compliance with the said proviso, I, the said William Brunton, do hereby declare that the nature of my said Invention, and the manner in which the same is to be performed, are particularly described and ascertained in the following description thereof, that is to say:—

My said improvements relate, first, to the furnace or fire-place of the engine boiler, which fire-place or furnace I make of a circular form, with the grate revolving horizontally, and having the fuel supplied from above; and, secondly, to the piston in the working cylinder, which piston I so form as to have an upper and lower packing, with a reservoir in its interior to contain oil, tallow, or any fit liquid, or any fluid metal or mixture of metals fusible in the temperature maintained by the steam, the said reservoir having a free communication with the working cylinder all round between the upper and lower packing. By making my fire grate to revolve in its own plane, I am enabled to supply the fuel from a box (or boxes) above through a hole (or holes) in the roof of the furnace in continued succession, or in small quantities at regular intervals, and thus to distribute the fuel equally and uniformly over the surface of the fire. And by the construction of my said piston, in which the tallow or other fit liquid or fluid metal contained in the said reservoir is brought into free and intimate contact with the working cylinder all round the said piston, the said oil, tallow, or other liquid or fluid becomes virtually a part of the said piston, and I am thus enabled to prevent any passage of steam (from the one side of the piston to the other) between the piston and the working cylinder.

My said improved furnace or fire-place, with its appendages, and my said improved piston, with its appendages, are constructed and made to operate in manner following, that is to say:—

The fire grate is ultimately supported by a vertical shaft (which I call the grate shaft), moveable round its axis, the lower end of which shaft stands in the ash-pit, and the upper end whereof is supported by a strong bar built into the brickwork of the ash-pit; from the upper end of the said grate shaft (above the said supporting bar) are extended two or more arms, carrying a strong cast iron ring (which I call the grate ring) concentric with the said grate shaft, and having its plane at right angles thereto; upon this grate ring I lay the grate bars, which are similar to those in common use, but of different lengths, suited to the places which they respectively occupy on the plane of the said ring, when placed parallel to its diameter, and to each other. To the exterior edge of the said grate ring, and about two inches below its upper surface, is attached another ring of cast iron (which I call the brick ring); the plane of this ring (which is also at right angles to the said grate shaft, and about six inches broad) terminates at its exterior diameter in a vertical rim,

rising about eight inches above the said plane, thus forming (with the said plane and the above-mentioned two inches of the grate ring) a circular case for a circle of fire bricks all round the grate, which fire-bricks should be of such a height as to stand about six inches above the surface of the grate, for the lateral support of the fire. To the under side of the said grate ring is fixed a rim or cylinder (which I call the air ring), made of strong sheet iron, projecting downwards about four inches into a circular trough of suitable diameter, made of cast iron, which trough is built into the brickwork of the ash-pit, and concentric with the said grate shaft. The said air ring is not suffered to touch the bottom of the said trough, but moves in sand, with which the trough is filled. The use of the said air ring is to prevent the passage of air between the said grate ring and the said trough. The inside of the furnace or fire-place (made circular, as already noticed) is constructed concentric with the fire grate, and about three inches more in diameter than the outside of the said brick ring. The wall rises of this diameter from the level of the bottom of the said sand trough in which the said air ring is carried round by the said grate ring. There is thus formed a cavity round the exterior of the said sand trough, to serve as a receptacle for any dust or ashes which may accidentally fall over the edge of the grate through the interstice of one inch and a half left all round the said brick ring by the greater diameter of the furnace. Into the said cavity I make two or three or more openings at convenient places through the brickwork, with doors upon the same (to be kept open or shut at pleasure) for the double purpose of cleaning out the ashes and of permitting a current of atmospheric air to have access through the said interstice of one inch and a half to the top of the fire to ignite the smoke. Through the wall of the furnace (which may be constructed of fire-bricks) an opening or flue is formed from the level of the top of the said brick ring, through which opening the flame passes to the boiler; and in the side opposite to this flue I usually place the fire door, which is of the common construction, and is used for the lighting and occasionally for cleaning the fire. In the roof of the furnace (which may also be of fire-bricks I construct a hole or opening (which I call the feeding hole) about five inches wide, one end of which is perpendicularly over the centre of the grate (or nearly so), and the other end over its circumference. Over the said feeding hole is placed the coal box (which I call the fire feeder, or, for brevity, the feeder), which is made large enough to hold a supply of coal sufficient for one or more hours. This fire feeder is in shape similar to the hopper of a corn mill, excepting that the bottom is made oblong (its length being equal to half the diameter of the grate, as already stated), and its width about four inches more than the said feeding hole in the roof of the furnace, that is to say,

about nine inches wide. The aperture through which the coal passes from the fire feeder is on one of its sides and close to the bottom, and this aperture is adjusted to the size of the pieces of coal used, by means of a sliding shutter raised or lowered as occasion requires, say varying from two to five inches. The bottom of the fire feeder is an iron plate, about twelve inches wider than the lower orifice thereof, and inclined downward about one in six towards the side on which is the aperture for discharging the coal, and in the same direction; it has a reciprocating motion upon a pivot fixed at that end of the bottom of the fire feeder which is next the centre of the grate, (that is, the pivot is directly over or nearly over the centre of the grate,) by which reciprocating motion the coal resting upon the bottom of the fire feeder (that is, on the said iron plate which has the said reciprocating motion) is passed through the foresaid opening in the side of the said feeder, and precipated over the lower edge of the said plate (through the said feeding hole), and thus (the grate being made to revolve by power obtained from the engine or from any other convenient source) the fuel (as noticed above) is distributed equally and uniformly over the whole surface or area of the fire grate; in order to prevent any air from entering the furnace through the said feeding hole, I connect the said feeder to the roof of the furnace by a box, which incloses the lower part of the feeder, with its moveable bottom plate, making a hole through the side of the said box of sufficient size to allow a rod to pass through to communicate the said reciprocating motion (obtained by connecting the same with the engine or other convenient power); and upon the upper edge, or the mouth of the fire feeder, I form a horizontal channel or gutter to hold water or sand, into which a rim projecting downwards from the under side of the cover of the said feeder is received, and thereby I prevent all passage of air downwards through the interstices among the pieces of coal. The said cover is suspended so as to be easily removed or lifted upwards when the feeder is to be supplied with coal.

No competent engineer will find any difficulty in connecting the said grate shaft with the engine, so as to make it revolve on its axis, and give the required motion to the fire grate, (the velocity at which I prefer the grate to move is one revolution in about six minutes for a grate of five feet diameter, and so in proportion for any other diameter,) or in borrowing therefrom the power necessary to give the reciprocating motion to the inclined moveable bottom of the fire feeder, but I shall hereby describe a method for doing so which will be easily understood. Upon the grate shaft, and at any convenient height above its lower end, fix a spur wheel nearly as large as the grate, to be driven by a pinion upon another vertical shaft turned by the engine, or other convenient power (introducing if necessary another wheel

between the said spur wheel and the said pinion, and proportioning the number of their teeth to the velocity wanted). Upon the last-mentioned vertical shaft fix one or more cams or eccentric curves, which being brought round by the revolutions of the said shaft may act against a lever connected with the sliding bottom plate of the fire feeder, and move it in one direction, at the same time raising a weight connected with and sufficiently heavy to move the said plate back again in the opposite direction whenever the cam or cams cease their action upon the said lever. The merely agitating or giving a tremulous motion to the feeder is not, though thus alluded to, claimed as being new. In order to regulate the quantity of coal introduced by each movement of the said sliding bottom plate, cause the said lever to act against or fall upon a wedge, which by moving longitudinally, will increase or diminish the space through which the said sliding bottom plate moves. This wedge may be attached to the common damper regulator of the engine boiler, in such manner that as the pressure of the steam increases, a smaller quantity of coal will be suffered to pass from the fire feeder into the furnace, and *vice versâ*. Upon the said grate shaft above, and resting upon the said spur wheel, I fix a circular plate of iron, somewhat larger than the fire grate; upon this plate the ashes fall, and are by the motion of the plate urging them against an eccentric bar of iron (which bar is fixed to the side of the ash-pit,) swept from the surface of the plate into a box or pan, by which they may be removed without the labour of the shovel. This pan is chiefly applicable when the ash-pit is to deep to be conveniently emptied by the shovel. With my said improved furnace or fire-place, having a revolving grate, and fed with fuel in the manner that has just been described, the smallest coal may be used, but pieces larger than would pass through (in every direction) a ring four inches in diameter, must be broken previous to their being put into the fire feeder.

I have noticed above, that the sides and roof of my said improved furnace may be constructed of fire-bricks; but where the application of my said improved furnace is for the purpose of raising steam not exceeding eight pounds pressure on the square inch, I prefer and usually construct a vessel, which I call the supplementary boiler, the bottom of which is raised in such a manner as to form the sides and roof of the fire-place. Through the vertical part of this boiler (that part which forms the side of the fire-place) I construct an opening for the fire door, and through that part which is over the fire grate I construct the feeding hole before mentioned for introducing the fuel. I usually make this supplementary boiler to inclose about two thirds of the circumference of the fire grate, making it terminate at the uninclosed one third part of the circumference in that shape which may be best adapted for joining it to the principal boiler, (regulating the said shape by the form of the said principal

boiler,) and maintaining a free communication between the water in both, and joining their tops by a steam pipe, for the purpose of maintaining an equlibrium of pressure. In applying my said improved furnace to a boiler for raising high pressure steam, I construct my supplementary boiler of tubes of wrought or cast iron, composing the roof and sides of my said furnace of such tubes, (connected with the principal boiler,) supporting the said tubes with suitable brick, and in an interstice of two of the said tubes, placed at a suitable distance from each other, I form the feeding hole for the coal to pass through from the fire feeder. In the description which I have thus given of my supplementary boiler, I am not to be understood as claiming as any part of my said Invention the placing of a boiler (whether one entire vessel or composed of tubes) over the fire grate, but only and exclusively (so far as relates to the boiler) the constructing through the said boiler and over the fire grate the foresaid feeding hole for introducing the coals from the fire feeder, and the attaching the fire feeder to the said supplementary boiler, (answering the purpose of a roof to a furnace,) in such a manner that air may be prevented from descending into the furnace through the said feeding hole, as above described.

I now proceed to describe my said improved piston (with its appendages) for preventing the passage of steam between the piston and the cylinder. Whether the said piston (which I call my double piston) be intended for a double or for a single engine, it is composed of an upper and lower parts, which parts, though united to each other, I (for convenience) call the upper and the lower pistons; for the present let the upper piston of the double engine be conceived similar to the piston in common use. To the under side of this is attached the lower piston, packed in a similar manner. By means of this lower piston, I form a receptacle or reservoir for any suitable fluid, as melted tallow, mercury, or (which I prefer) any fusible mixture of metals capable of being kept fluid in a temperature of two hundred and twelve degrees of heat, in which reservoir the upper piston is always immersed, but in such a manner that its circumference does not reach or touch that of the lower piston, a space being left between the upper and lower piston all round to allow the fluid contained in the said reservoir to have free access to the surrounding working cylinder, so that no steam can pass either upward or downward past the piston while any of the said fluid remains in the said reservoir. Figure 1, attached hereto,) will give a perfect idea of the structure of my said double piston, as applicable to the double engine.

A, A, is a section of the upper piston.

B, B, its cover or ring.

C, C, is a section of the lower piston.

D, its ring.

E, the packing of the upper piston.

F, the packing of the lower piston.

G, G, the reservoir containing the said fluid for preventing the passage of steam.

H, the circular opening, to allow the fluid to come in contact with the cylinder all round the double piston.

Through the lower piston I make a hole or holes (*a*), communicating with the said receptacle above the surface of the said fluid, and large enough to admit steam freely and in sufficient quantity to maintain the lower side of the said lower piston and the said reservoir in a state of equilibrium. In this state the said fluid contained in the said reservoir has no other tendency to pass the side of the said lower piston than its own gravity. During the ascending of the entire or double piston the steam acting upon the surface of the fluid in the said reservoir, has a tendancy to force part of it past the side of the said double piston, into the vacuous, that is, into the upper part of the cylinder above the double piston, and during the descent of the said double piston, the fluid that is above it, or a portion thereof, is by the force of the steam downward returned past the side of the upper piston into the said reservoir. In order that any portion of the said fluid which may pass downward between the cylinder and the lower piston may be collected and returned again into the said reservoir, I construct a groove or gutter *b*, *b*, round the cylinder bottom, but which groove or gutter in the bottom of the cylinder I do not claim as new, or of my Invention; and to the said groove or gutter I connect, by means of a cock or valve (*c*), which I call the *under fluid valve*, a vessel (*d*), of suitable capacity, say, capable of containing three or four hundred cubic inches, or more or less according to the size of the engine, which vessel (called by me the receiver I inclose in another outer vessel (*e*, *e*), which properly speaking is a steam case, being kept full of steam to maintain the fluidity of the fusible metallic mixture (which I prefer to tallow or any other fluid), while collecting or contained in the said receiver (*d*). To the top of the said receiver I attach a pipe, with a steam valve or cock (*f*), which pipe has its other end opening into the steam part of the boiler, and from the interior of the said receiver there is an ascending pipe (*i*, *h*,) having a cock or valve (*g*), which call the *upper fluid valve*. The lower orifice (*i*) of this pipe is so close to the bottom of the said receiver as only to allow the surrounding fluid metal to gain ready access into the said pipe when pressed on by steam admitted for that purpose through the steam valve or cock (*f*), and the upper end opens into the cylinder of the engine above the range of the piston. The said pipe is steam-cased, to prevent any chilling of the fluid metal while passing from the lower reservoir to be thrown into the working cylinder above the piston; while in operation the under fluid valve (*c*) is open to allow the fluid to pass from the groove (*b*, *b*,)

into the receiver (*d*), and while the said fluid is thus collecting in the said receiver, the other two cocks or valves (*f*) and (*g*) are shut. But when the fluid is to be raised from the said receiver, and sent into the top of the working cylinder, then the said under fluid valve (*c*) is shut, and the steam valve (*f*) and the upper fluid valve (*g*) are both open. The steam being thus brought to act upon the surface of the fluid in the receiver, forces it up the said ascending pipe (*i*, *h*), whence by the upper orifice (*h*) it is discharged on the top of the double piston. When the fluid has been thus tramitted from the receiver to the upper side of the double piston, the upper fluid valve (*g*) and the steam valve (*f*) are to be again shut, and the under fluid valve to be again opened to permit the fluid that passes the piston to be collected again in the receiver. In cases where the working cylinder is higher than the pressure of the steam can raise the fluid, I then apply two or more sets of the forcing apparatus that has just been described, so constructed and connected that the said fluid may be forced to ascend by successive steps till it is raised to the requisite height, and discharged into the working cylinder, as already described. The valve or valves through which the fluid metal passes are best made of iron. The steam valve may be of brass, and the fluid metal and steam valves are so connected by the well-known means of levers that by one movement of the hand the whole may be moved in the manner required by the nature of the operation; or without using any part of the said forcing apparatus my said improved piston may be kept in a proper state of action by the person who attends the engine drawing off occasionally from the said receiver the said fluid metal therein collected, and introducing the same by hand through a funnel and cock in the cover of the working cylinder.

In applying my said double piston to the working of single engines, all the parts are essentially the same as those above described for the double engine, but with this difference:—The upper piston is so formed that the reservoir is three inches (or thereabouts) higher than the top of the packing ring or cover of the upper piston (see Figure 2); through the upper piston I form one opening or two or more openings (*k*), by which part of the fluid in the reservoir (when the same is full) may flow upon the top of the packing of the upper piston during the ascending of the double piston, or when it is in equilibrio. Upon or in each of these openings I place a valve or valves (see Figure 2) to permit the fluid to flow from the reservoir, but to resist its return thither. The fluid thus diffused on the top of the entire piston prevents the passage of steam downwards, and whatever portion of the fluid is forced past the side of the piston finds its way into the receiver, whence it is forced from time to time, or transferred by hand to the upper side of the piston, as above described.

A.D. 1819. June 29. Nº 4,387.
BRUNTON'S SPECIFICATION.

(1 SHEET)

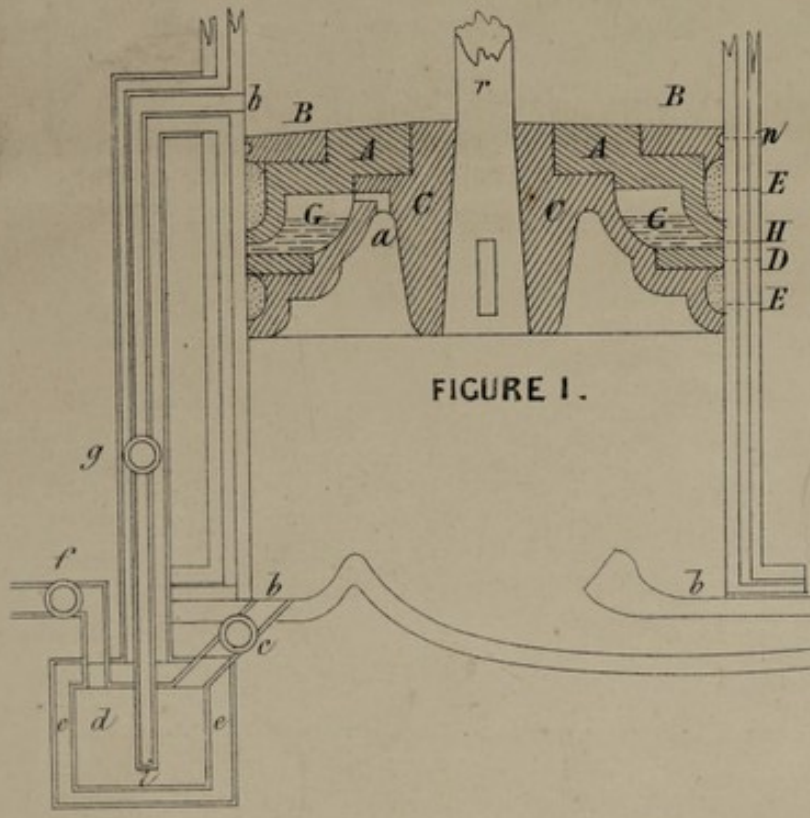

FIGURE 1.

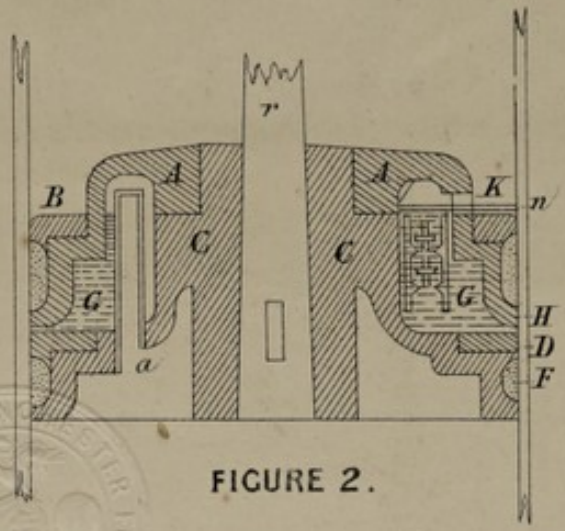

FIGURE 2.

Malby & Sons, Lithe.

The enrolled drawing is not colored.

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Printers to the Queen's most Excellent Majesty. 1854

In constructing my said improved piston, whether for the double or for the single engine, it is of great importance that the upper and lower parts (or pistons) be concentric with each other and with the piston rod *r*. To effect this concentricity, I commonly attach the piston rod to the lower piston, and this I do in the usual manner; and I fit the upper piston to the lower piston (by a well turned grown'd joint), fastening them securely to each other by strong screws, by which construction I am enabled to remove the upper piston entirely when this may be occasionally required in order to pack the lower piston. I have further to state, that sometimes I make in the edge of the ring or cover of my upper piston a groove or circular cavity (*n*), for the purpose of keeping the fluid against the side of the cylinder; but this is not absolutely necessary, for the top of the said pinion being made somewhat conical, the natural tendency of the fluid is towards the circumference; it is advisable that some suitable receptacle should also be connected with the eduction pipe, that any of the fluid metal which may chance to pass that way may be recovered.

In witness whereof, I, the said William Brunton, have hereunto set my hand and seal, the Twenty-second day of December, in the year of our Lord One thousand eight hundred and nineteen.

WILLIAM (L.S.) BRUNTON.

Signed, sealed, and delivered by the within-named William Brunton, in the presence of

RICH[D] BIRD,
Attorney-at-Law,
Birmingham.

AND BE IT REMEMBERED, that on the Twenty-fifth day of December, in the year of our Lord 1819, the aforesaid William Brunton 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 Statute made for that purpose.

Inrolled the Twenty-seventh day of December, in the year of our Lord One thousand eight hundred and nineteen.

TYNDALL, Extra.

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