A.D. 1818 . . . . . N° 4231.

SPECIFICATION

OF

ALEXANDER HALIBURTON.

STEAM ENGINES AND BOILERS.

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HALIBURTON'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, ALEXANDER HALIBURTON, of Haigh Iron Works, near Wigan, in the County of Lancashire, Esquire, 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-seventh day of February, in the fifty-eighth year of His reign, give and grant unto me, the said Alexander Haliburton, my exors, admors, and assigns, His special licence, full power, sole privilege and authority, that I, the said Alexander Haliburton, my exors, admors, and assigns, should and lawfully might, during the term of years therein mentioned, make, use, exercise, and vend, within England, Wales, and the Town of Berwick upon Tweed, my Invention of "CERTAIN IMPROVEMENTS IN STEAM ENGINES AND BOILERS;" in which said Letters Patent there is contained a proviso that if I, the said Alexander Haliburton, 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 two 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, may more fully and at large appear.

NOW KNOW YE, that in compliance with the said proviso, I, the said Alexander Haliburton, 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 Drawings hereunto annexed, and following description thereof (that is to say):—

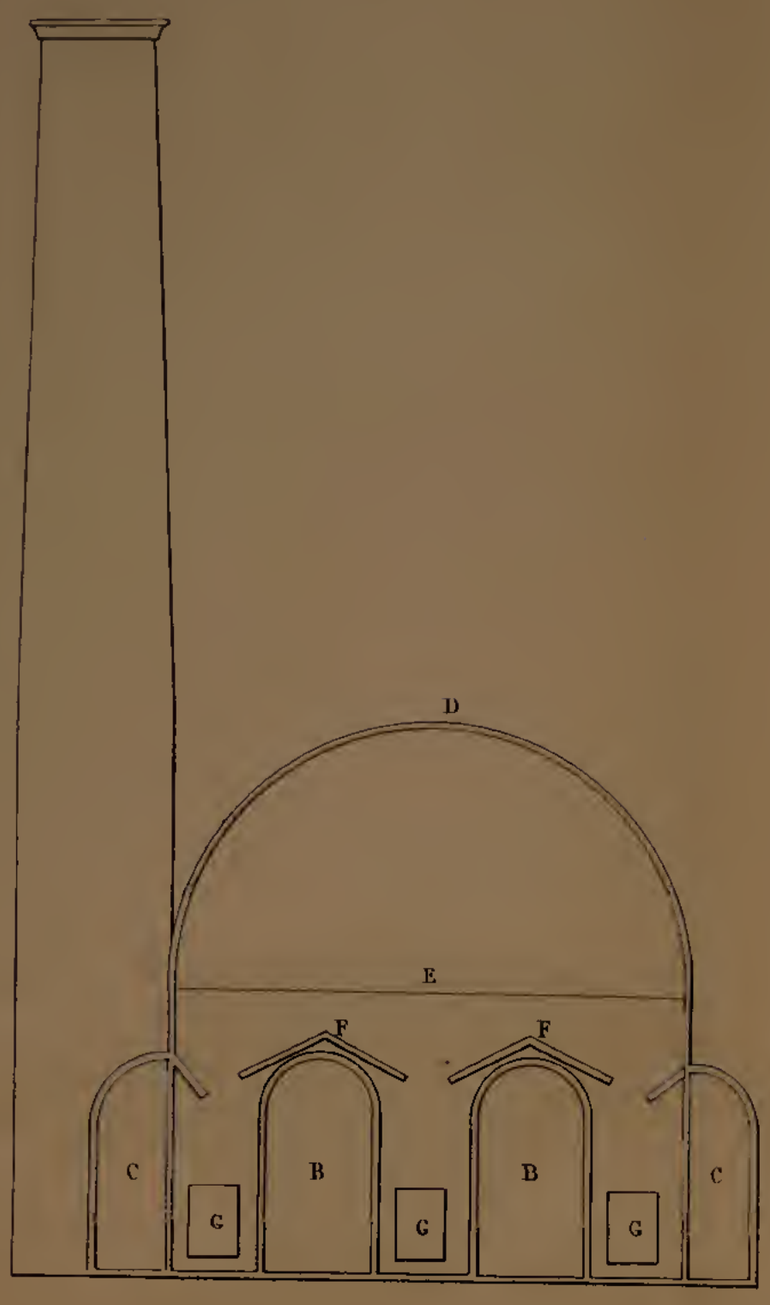
The pressure of steam has hitherto been considered as the only cause of the bursting or explosion of steam engine boilers, and consequently the means of prevention have been chiefly confined to the improvement and regulation of the safety valve. It will however appear, from a closer attention to the subject, that the mere expansive force of steam does not sufficiently account for all the phenomena. In many of the cases related, and in one which came under my own observation, the boilers were not only burst but actually raised up from their seats and carried to a considerable distance, along with bricks and other matters attached to them, which could not have taken place from the pressure of steam in a boiler from which the atmosphere is excluded, for there it acts alike in all directions, upwards, downwards, and latterally. Some other agent must, therefore, be looked for besides the mere expansion force of the steam. This cause appears to me to be the explosion of hydrogen gas arising from the decomposition of the water by the iron, and which, under certain circumstances, comes in contact with the flame of the furnace. When the pressure of steam is great, which it necessarily must be in the non-condensing engine, or when the feeding apparatus gets deranged, a sufficient supply of water is prevented, and consequently some portion of the bottom and sides of the boiler, which are in immediate contact with the fire, are left uncovered. Under these circumstances the parts of the boiler so exposed are soon heated to redness, and the water that remains in its lower cavities in a state of ebulition coming at brief intervals over the red hot parts of the vessel, some portion of every wave is decomposed, and hydrogen gas produced. If in such circumstances the overheated metal is melted or burst through by pressure, the gas will rush through the aperture into the furnace, and, meeting with flame, will instantly be exploded. Another cause of the rapid destruction of steam boilers arises from the impurity of the water employed. At sea or in rivers, where the waters of the ocean have access, there is held iñ solution marine salt and other and other saline and earthly matters, which are more or less deposited on the bottom of the boilers in proportion to the quantity converted into steam. The waters of the greater number of springs also hold earthy matters in solution, which are likewise precipitated in the same manner. This deposit, besides hastening the descomposition of the boiler, forms a hard crust, slowly permeable by heat, which,

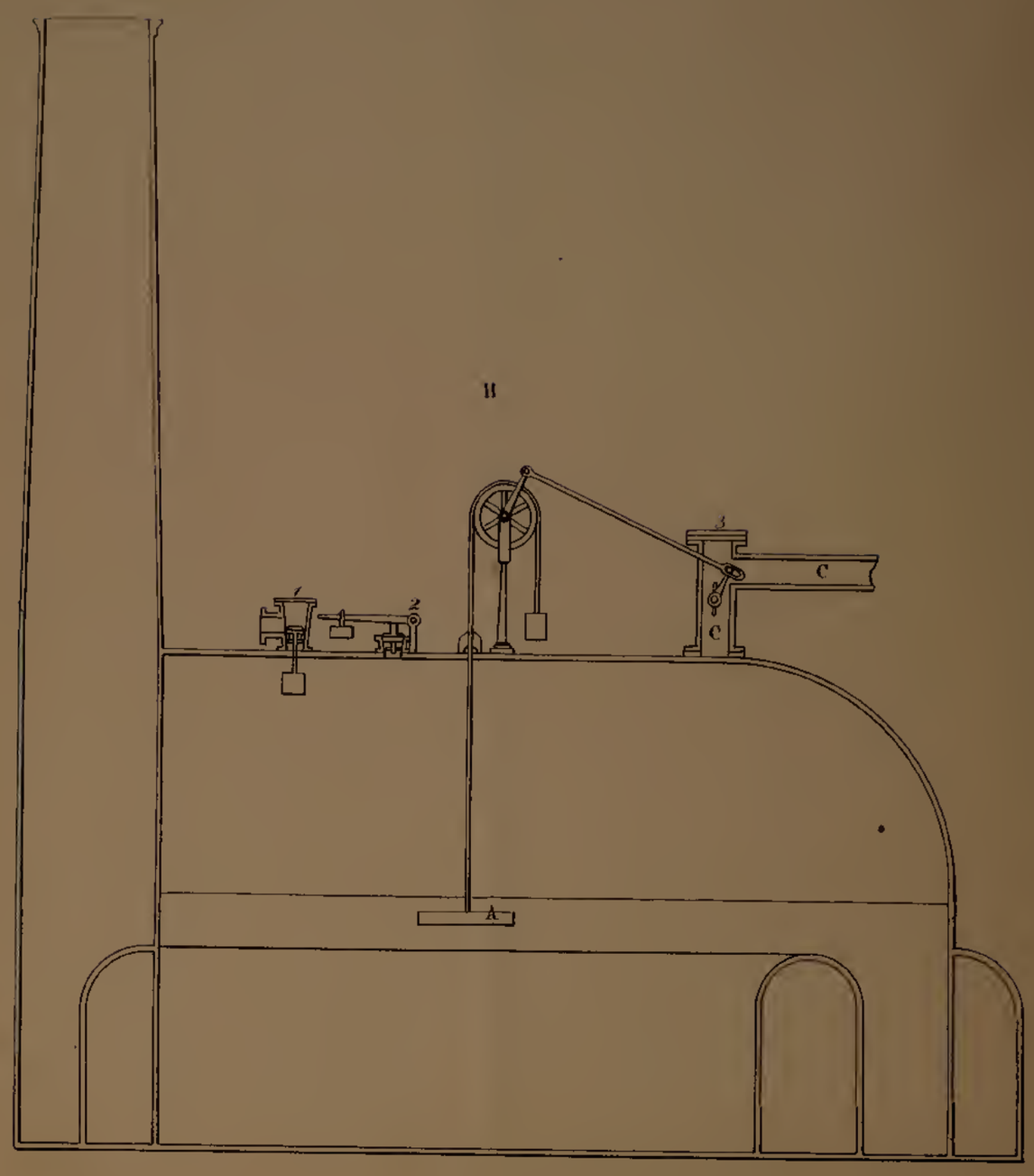
reacting upon the metal, soon causes the destruction of some part of the boiler. If the foregoing views of this important subject are correct, and from the facts stated there seems to be no doubt but that they are so, it will follow that no precautions short of preventing the production and explosion of hydrogen gas, and the deposition of sediment on the bottom of the boiler, will prevent the recurrence of those terrible events, the subject of so much dread and alarm to the public.

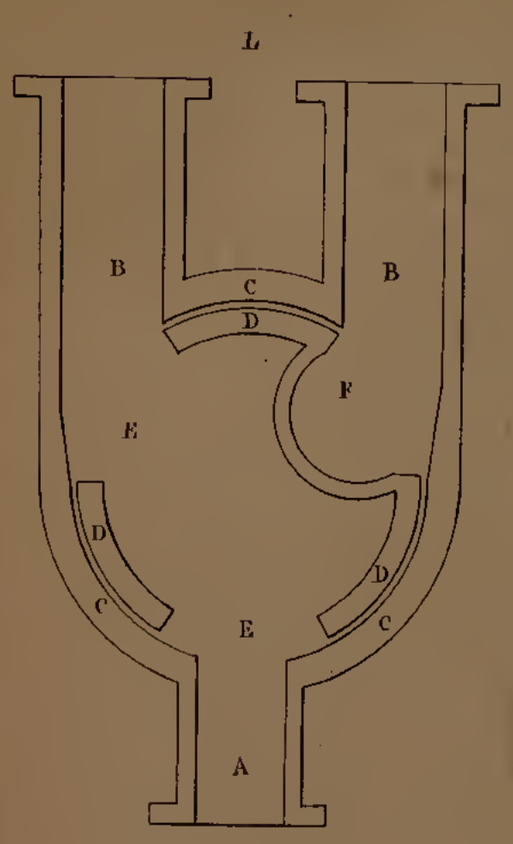
My boiler is, therefore, formed upon principles which will effectually obviate these great evils. Firstly, by insuring such a supply of water as to keep the boiler always filled to a point above all the parts that are exposed to the immediate action of the fire. This I accomplish by a water-regulating valve so constructed as to descend with the water in the boiler, and by means of levers operating upon a valve in the steam pipe, to stop the motion of the engine altogether before the water in the boiler can be so far exhausted as to leave any part of the inner surface of its bottom dry. And, secondly, by preventing the saline or earthly deposits from resting upon any part or parts subject to the principal action of the furnace. The tops of the flues in this boiler are the only parts in immediate contact with the fire, and in order effectually to prevent any deposit from settling thereon, I place a shelf or shelves, saddle or saddles of iron, wood, or other convenient materials horizontally, diagonally, or in any other position that may be judged best, in some part within the boiler between the upper and lower surfaces of the water, to receive the earthy, saline, or other impurities which may be precipitated from the water during its conversion into steam; from which shelf or shelves, saddle or saddles, the said deposits are either removed or allowed to precipitate into the cavities between the flues, and from thence taken away occasionally by means of proper doors or other contrivances for that purpose.

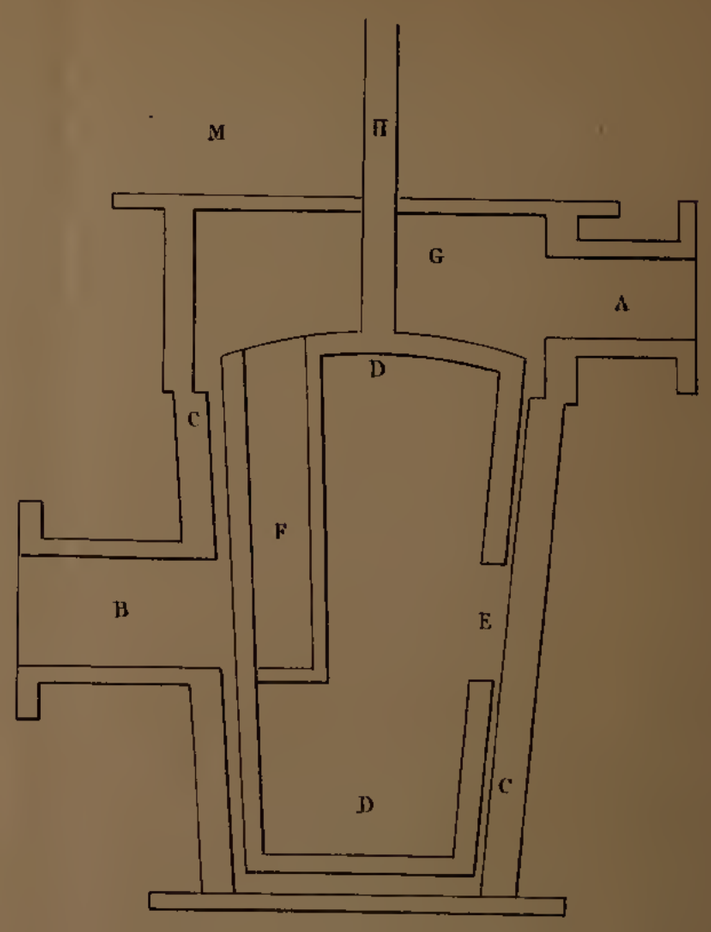
Figure A in the Drawing hereto annexed is a ground plan of the boiler; B *v*, B *v*, is the interior flue, which makes a complete revolution in the water, and then goes into the exterior flue; C, C, the exterior flue, which makes a revolution on the outside of the boiler and discharges into the chimney E. Figure D is an end section of the boiler; the line E represents the height of water in the boiler; F, F, the shelves or saddles, suspended over the tops of the flues, upon which any deposit will take place, and thereby prevent the encrustation of the tops of the flue B, B. These shelves or saddles may be either suspended by rods from the top of the boiler or supported by their extremities from its ends. C, C, is the exterior flue, which passes into the chimney. This flue I make of cast or wrought iron, to facilitate the setting of

the boiler in places where building is inconvenient. G, G, G, small doors or man-holes, by which the deposit may occasionally be removed. Fig. H *o*, is a section and elevation of the boiler and chimney with the safety valves 1 is a safety valve, loaded within the boiler to a certain pressure, and not subject to the controul of the engineer; 2, a safety valve under the management of the engineer; 3, a water-regulating valve for the purpose of stopping the engine before the water can be reduced to the level of the top of the flues. This is worked by the float A immersed in the water of the boiler. When the water is evaporated to a certain point the abstraction of floatage from A causes it to revolve the wheel B, which operates by the well-known means of levers attached to its axis upon a valve contained in the steam pipe C, and cuts off the communication with the engine. Thirdly, my improvement in steam engines consists in the invention of a valve, which by a simple motion not liable to be put out of order, admits steam to one part of the cylinder, and cuts off its passage to the other part, whilst its affects a simultaneous connection between the latter and condenser. Figure L is a cross section of the valve; A is the steam pipe, which communicates with the boiler; B, B, the steam passages, which terminate in the upper and lower divisions of the cylinder; C, C, C, are the external surfaces of the valve, which is of the form of a trancated cone, and into which the hollow stopper D, D, D, is ground air-tight. This hollow stopper contains in its circumference three equi-distant steam ways or passages, represented by E, E, F, two of which E, E, meet in the hollow of the stopper, and through it communicate with the condenser. The other passage F does not communicate with the interior of the stopper, but terminates in a chamber on its top formed by a prolongation of the outer case, and into which the steam pipe A discharges. Figure M is a vertical section of the valve; A, the steam pipe; B, one of the pipes which communicate with the cylinder; C, C, the external case, which forms the chamber G by its prolongation; D, D, D, the hollow stopper, which communicates at the bottom with the condensor; E, one of the eduction pipes, which discharge through the stopper; F, the steam way which opens into the chamber G, and has no communication with the hollow of the stopper; H, the rod by which the valve is worked; it passes through a stuffing box in the usual manner, and may be worked by means of an escentric motion or any other of the methods usually employed for such purpose. The working of the valve consists in causing the steam passage E to alternate between the passages B, B, and in consequence of F being equi-distant between the eduction passages E, E, one of these passages will always coincide with one of B, whilst F is supplying the









The enrolled drawing is not colored.

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other with steam, and so the motion of the engine will be effected by the upper and lower divisions of the cylinder being alternatively supplied with steam and the steam condensed.

In witness whereof, I, the said Alexander Haliburton, have hereunto set my hand and seal, this Twenty-fourth day of April, in the year of our Lord One thousand eight hundred and eighteen.

ALEX. (L.S.) HALIBURTON.

AND BE IT REMEMBERED, that on the Twenty-fourth day of April, in the year of our Lord 1818, the aforesaid Alexander Haliburton came before our said Lord the King in His Chancery, and acknowledged the Specification aforesaid, and all and every thing 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.

STEPHEN.

Inrolled the Twenty-fifth day of April, in the year of our Lord One thousand eight hundred and eighteen.

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