HISTORY & PROGRESS

OF

The Steam Engine.

BY ELIJAH GALLOWAY.

WITH AN

EXTENSIVE APPENDIX,

BY LUKE HEBERT.

W. Burdett Dobson 1845

HISTORY AND PROGRESS

OF THE

STEAM ENGINE;

With a Practical Investigation

OF ITS

STRUCTURE AND APPLICATION:

BY ELIJAH GALLOWAY,

CIVIL ENGINEER.

TO WHICH IS ADDED

AN EXTENSIVE APPENDIX,

CONTAINING MINUTE DESCRIPTIONS OF ALL THE VARIOUS IMPROVED BOILERS; THE CONSTITUENT PARTS OF STEAM ENGINES; THE MACHINERY USED IN STEAM NAVIGATION; THE NEW PLANS FOR STEAM CARRIAGES; AND A VARIETY OF

ENGINES FOR THE APPLICATION OF OTHER Motive Powers,

WITH AN EXPERIMENTAL DISSERTATION ON THE NATURE AND PROPERTIES OF STEAM AND OTHER ELASTIC VAPOURS; THE STRENGTH AND WEIGHT OF MATERIALS, &c. &c.

BY LUKE HEBERT,

Editor of the Register of Arts, and Journal of Patent Inventions.

ILLUSTRATED BY

Upwards of Two Hundred Engravings.

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1832.

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TO THE

MECHANICS OF GREAT BRITAIN,

WHOSE INTELLIGENCE, INGENUITY, AND INDUSTRY,

CONSTITUTE THE WEALTH AND GLORY OF THE PEOPLE,

BY WHOSE TALENT IN CONTRIVANCE AND EXECUTION

IN MACHINERY OF EVERY DESCRIPTION,

This Nation

HAS BEEN ENABLED TO SURPASS ALL OTHERS IN THE EXCELLENCE OF HER MANUFACTURES,

AND WHO, IN PARTICULAR, HAVE BEEN CHIEFLY INSTRUMENTAL

IN BRINGING

The Steam Engine

TO ITS PRESENT STATE OF IMPROVEMENT,

THIS HISTORY OF ITS INVENTION AND PROGRESS

IS DEDICATED,

BY THE AUTHORS.

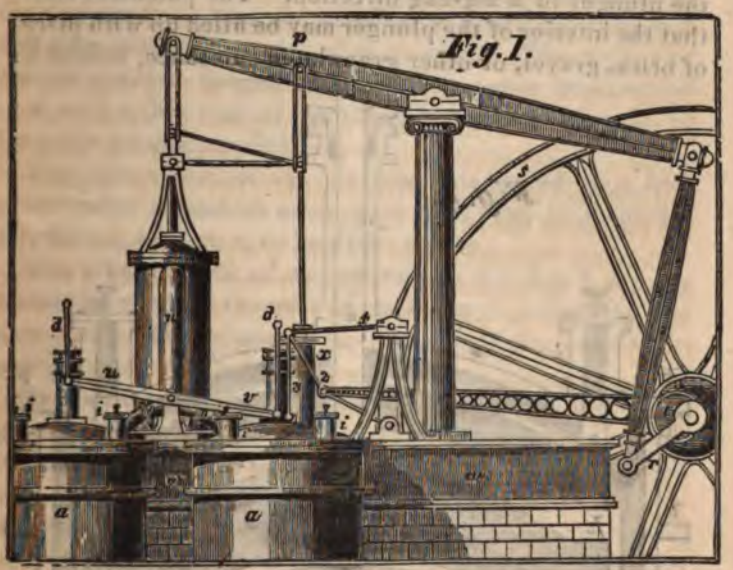
of the piston, by the action of a powerful pump, on Bramah's principle.

As the difference of heat between sunshine and shade, is, under some circumstances, sufficient to work an engine of this kind, a *furnace* as before mentioned, in the ordinary conception of that term, is not required, but any convenient means of communicating a slight increase of temperature.

Patent Air Engine, by R. and J. Stirling, of Glasgow. 1827.

Messrs. Stirling's machine resembles the steam engine in the construction and application of many of its parts, such as the cylinder and piston, the reciprocating beam and parallel motion, and the fly-wheel and crank, as represented in Fig. 1. Motion is communicated to the

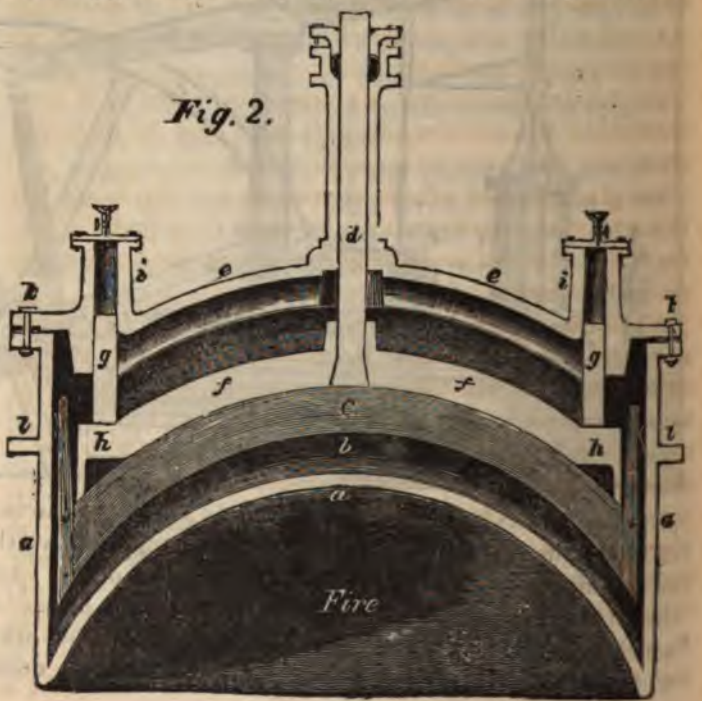
Fig. 1.



piston in the cylinder, *o*, by alternately heating a portion of air connected with one side of the piston, and at the same time cooling that in connexion with the other. And this is effected by means of the air vessels *a a*, one of which communicates with the upper part, and the other with the lower part of the cylinder, through the nosles

m m, the pipe *n* forming the communication between one of the nosles *m*, and the top of the cylinder. Fig. 2, represents a section of one of the air vessels, whose sides are cylindrical, and top and bottom spherical. This air vessel, which is made of cast iron, and supported in the brick work by the projecting ledge *l l*, is furnished with a plunger, *c C c*. The top and bottom of the plunger is made of strong sheet iron, perforated with very numerous small holes, to admit the air. The interior of the plunger is filled with very thin plates of sheet iron, so bent as to prevent their flat sides from coming into contact, that the air may have a free passage between them. These are also perforated with small holes, which holes are placed opposite to each other, but so arranged as to cause the air to pass through the plunger in a zig-zag direction. The patentees state, that the interior of the plunger may be filled up with pieces of brick, gravel, or other granulated substance, instead of

Fig. 2.



the thin sheet-iron. The plunger is formed circular, to fit the top and bottom of the air vessel, when drawn up and down. The rim *c c* of the plunger, which moves in a cylindrical receptacle at the circumference of the air vessel, as represented, is not perforated as the other part. It is kept steady by the spring *u u*, consisting of a belt of thin sheet-iron, attached at its upper edge to the rim *c c*; a number of slits are made from the lower edge of the belt, to admit of its being bent outwards, to rest against the air vessel, and act as a spring. The plunger is also kept steady in its ascent and descent, by the plunger-rod *d*, passing through the stuffing-box at the top of its case, and the guide rods *g g*, which work in the guide cases *i i*, figs. 1, and 2. The guides are fixed to a ring *h h*, which is attached to the plunger and the plunger-rod, by the arms *f f*, four in number; they are supplied with oil, by an oil cup and stop-cock at the top of their cases. The top *e e* of the air vessel is flanged down in the manner represented at *k*, with a thin ring of sheet lead between the flanges, to keep the joining air-tight.

The lower part of the air vessels is heated by a fire-place under it, and its upper part kept cool by a current of cold air, by water, or by other means.

The plunger-rods of the air vessels *a a*, fig. 1, are attached by slings to the ends of the beam *v*, so that the motion which elevates one plunger in one of the vessels depresses that in the other.

When the plunger is raised, the cold air in the upper part of the air vessel will be heated in passing through the interstices of the plunger in its ascent, which has itself been heated on reaching the lower or hot part of the vessel, and during this time the air in the other vessel will be cooled, by passing through the interstices of the plunger in its descent, which has itself been cooled by reaching the upper or cold part of the vessel. These changes of temperature are further augmented, by portions of the air being alternately changed from the hot to the cold, and from the cold to the hot parts of the vessels, by the alternate occupation of the hot and cold parts by the plunger.

Now, as one of the air vessels is connected with the top, and the other with the bottom of the working cylinder *o*, there will be a motion produced on the piston, by the alternate application of the expansive force of heated air, and this motion is communicated to the beam *v*, through the piston rod and parallel motion *q*, and to the connecting rod at the other end of the beam, and the crank *r*, to the fly-wheel *s s*. On the axis of the fly-wheel is fixed an eccentric *l*, which communicates motion to the plungers in the air-vessels, through the system of levers 1, 2, 3, 4, and the beam *v*; and this motion is adjusted so that the change of the plungers shall be effected, whenever the piston reaches the top or bottom of the cylinder; thus applying to that end of the cylinder where the piston is, the hot air, which, by its increased elasticity, will drive the piston to the other end.

The diameter of the nosles, *m*, is one-fifth the diameter of the cylinder *o*, and one-fifteenth of the diameter of the air vessel *a*.

This engine is also furnished with an air-pump, the piston rod of which is shewn at *x*, for condensing air into the air reservoir *w w*. The air is permitted to pass through self-acting valves into the nosles *m m*, and thence into the cylinder *o*, or the air vessels *a a*, but not permitted to return from these vessels or the cylinder into the reservoir, which is also provided with a safety-valve for the escape of superfluous air, when more is pumped in than is necessary to supply the air vessels. The diameter and length of the stroke of the air-pump are half those of the cylinder, but this appendage is not required to be kept constantly at work.

The patentees state, in their specification, that any of the permanent gases may be employed, instead of atmospheric air. They do not claim, as their invention, the application of these bodies to produce motion; but merely the foregoing arrangement of machinery, for applying the elastic force of gaseous bodies to the production of motion