gauge-cocks for ascertaining the height of the water, the puppet-clack or safety-valve, loaded with a sufficient weight, and having a string attached to it, so that the attendant on the engine can raise it when necessary to allow the steam to escape. The boiler has also a man hole, which is better seen at Z in fig. 30. The curved smoke-pipe D is surrounded by a copper casing, into which the water for feeding the boiler flows from the hot well, so as to be highly heated before being admit ted into the boiler. The other parts of the engine shown in the figure are, G the cylinder, into which the steam from the boiler flows through the pipes *d e* H I, which are jointed at *f for* the readier taking asunder, K the piston, G the piston-rod, H the receiver for the steam, containing the regulator-valve, I the steam-pipe, L the snifling-clack, M the injection-cock, N the injection pipe, *P p y* the plug-frame, *e m* arms of the tumbler on which the plugs act, *k o* a rod connecting the end of the tumbler with the handle of the regulator, w *b x z* the faller or F lever, with its detent or catch at o.

But the most magnificent of Smeaton’s works in this department of his profession is his great Chasewater engine, of which the details are given in his Reports. This engine was of 150 horses' power, turning out 880 hogsheads of water per hour, by the heat of 16½ bushels of coal. We have given a cut of this engine, Fig. 32 ; and we recommend the engineer to consult the original in Smeaton's Reports, as it is full of ingenious contrivance and judicious arrangement. The cylinder AB is 72 inches in diameter, the stroke 10 feet 6 inches. The great beam of the engine, DD, consists of twenty large balks of timber, the four nearest the centre being each a foot square, and the whole firmly joggled together with heart of oak, and bolted with iron, forming a very elegant but pon­derous beam. The cylinder beams FF, upon which the cylinder rests, and which are kept in their place by being

entered into the side walls of the house, are joggled and framed together in a similar manner to the great lever. G is the boiler, H the furnace, I B the steam pipe, J the injection-pipe, K the cistern for the injection water, fed by a pump L, which is wrought by the great lever of the engine, M the waste-pipe for the condensed steam, N the spear or pump-rod of the great draining-pump wrought by the engine, P P the plug-tree suspended from the main beam carrying plugs, which in its upward and downward progress act on the levers which open and shut the regulator and injection-cocks. The date of this engine is 1775. The working gear of the engine is very simple and good. It is represented on a larger seale in the accompanying cut, fig. 38.

A is the lower corner of the cylinder, A’ A, A' the injection-pipe, B the injection-cock, B F its handle or spanner passing between the forks of the bent lever E Z F Fζ called the F lever, by which the cock is opened and shut. The tail Z 12 of this F lever is, by the downward motion of the plug-tree P, forced from the position shown by the dotted line Z 18, into the position in which it is seen in the drawing, and it is there retained by the catch *I I I.* While the lever is in this position the injection-cock is shut, the steam from the boiler is flowing into the cylinder, and the piston is rising. When the piston has nearly reached the top of its course, an apparatus attached to the plug-frame P, draws up the catch *III,* and releases the F lever, which is forced into the position 18 Z, by the bob or weight 16, carried by its end F,, and the consequent movement of its fork F opens the injection-cock; T *x* 11, 9, is the Y lever or tumbler, which acts upon the stirrup rod *k* attached to the spanner of the regulator, as in Beighton’s gear, figs. *25,* 27. The range of the tumbler's motion on each side of the perpendicular is regulated by its check-cord T I, which is passed round a roller I, furnished with a paul and ratchet, so that its length may be ad justed. The tumbler is moved by pins in the plug-frame P, acting upon its bent arms *x* 3, *x* 7.

In the lefthand comer at the bottom of the figure is seen a representation of a slider, which may he fixed upon the plug-tree instead of the pins, to work the lever. There is both a side and a front view of the slider. Q R shows a part of the plug-tree, N V the slider, and W 20 W 20 two screws for retaining the slider in its place. By this