In the early stages of its evolution, the steam-engine assumed various forms, some of which, though now obsolete, are of great interest to the model constructor. Design was influenced by several factors, including expediency or convenience in the materials and methods of construction available at the time; and also by traditional structural styles.

I have already explained that the preferred position for the cylinder, which was then usually the heaviest single component, was on the floor or bedplate; the difficulty of producing accurate straight slides, capable of resisting side thrust without undue friction, favoured the use of parallel motion for guiding the piston rod, or indirect action with long connecting rods, such as in beam, return-crank and steeple engines.

The class of engine known as the "entablature" or "table" engine made its appearance very early in the 1800s, but became most popular in the middle years of the century. Some very fine examples of these engines by Maudslay and other prominent makers were shown at the 1851 Crystal Palace Exhibition; they varied a good deal in design, some being of the indirect-acting type, with the crankshaft below the cylinder and the piston rod extended upwards to a rather spidery crosshead from which motion was transmitted by side connecting rods to the crank.

Architectural term

Others, such as the types illustrated here, had the cylinders mounted on the bedplate and the crankshaft mounted on an elevated platform—probably the first attempt at what came to be known as "direct-acting" engines.

In common with many other terms in engineering, the word "entablature" is borrowed from architecture, being in fact a legacy from the classic Greco-Roman era. Its definition (to quote a standard architectural textbook), is "the horizontal member or members supported by the columns, and including the cornice, frieze and architrave."

All engines in this class, therefore, have the common feature of a flat elevated table supported by four (sometimes more) columns—comparable in fact to the humble kitchen table. Many of the classic examples of these engines had fluted Corinthian columns with decorated capitals and moulded edges to the entablature.

SIMPLE "BASIC" DESIGN

The engine illustrated in Fig. 34 represents one of the simplest possible designs in this class, being reduced almost to the point of austerity, yet fully in character. It is of the direct-acting type, having a sliding crosshead with bar slides. Both the baseplate and the entablature are made from flat plate, the former being 1/4 in. thick with chamfered top edges, and the latter 1/8 in. The columns may be built up, as indicated in the part section, the ends being shouldered down to form studs, with separate capitals and pedestals fitted to them. This is economical with material, but I have a predilection for making things in one piece where this is possible by straightforward machining and I think I should prefer to turn...
them from 1/2in. square bar, leaving flanges about 1/16 in. wide unmachined at each end, with simple mouldings adjacent to them and the rest of the shank tapered from 5/16 in. to 1/4 in. dia. Needless to say, the length between flanges must be the same in all cases, and not only must the flanges be square with the sides of the entablature but the latter must also have square corners, not rounded; as Muncaster says, “it is a sound rule in architecture that no cylindrical part appears about the square cap of a column.”

Brass is often used for the structural parts of these steam-engine models on the grounds of appearance, or avoidance of rust, but in the prototypes nearly all parts were made of cast or wrought iron. The cylinder is 3/4 in. bore x 3/4 in. stroke, the design, including slide-valve, etc., following conventional practice. Piston and valve rod glands have oval flanges and the sides of the stuffing-box on the cylinder cover have flat surfaces for the attachment of the slide bars. The latter are splayed outwards at the top, with horizontal lugs to fasten to the underside of the entablature, but the sliding surfaces must be exactly vertical and parallel to the cylinder axis both ways. It is probable that these were intended to be forged to shape, and machined or filed only on the working surfaces; but most constructors will probably find it best to cut them from the solid.

The crankshaft, of the overhung type, has a 1/4in. dia. main journal and runs in plummer block bearings mounted on the flat surface of the entablature; the web or crank disc has a pin 5/32in. dia. fitted at 3/8in. radius, either by screwing or pressing in. A spoked flywheel, 3 in. dia., is fitted and it may be observed that if character is to be as faithful as possible both the rim and spokes should be thinner than is usual in modern practice.

The eccentric is attached to the shaft as close as possible to the main bearing, thus serving as an end locating collar, and this should enable the rod to be lined up with the valve rod without bending, which is always unsightly and frequently quite unnecessary. Forked ends are employed on both the connecting rod and the eccentric rod; the crosshead is of H-section with grooved faces to embrace the slide bars. Despite its simple construction, this design can be made into quite a handsome and dignified model and an efficient worker.

TWIN-CYLINDER OR “DOUBLE” ENGINES

The two further examples of engines in this class, illustrated in Figs 35, 36 and 37, are both the “double” type; having overhung cranks at either end of the shaft and a central flywheel; but the design could quite easily be adapted as a single-cylinder engine if desired. They are also much more elaborate in design than the foregoing example and best suited to construction from castings, though many, if not all, of the components could be produced by machining from solid or fabrication by brazing and soldering. The latter methods are often preferred by constructors who wish to obtain the utmost accuracy in details such as fluting and other forms of decoration, which was such an attractive feature of these old engines.
Very little descriptive matter was furnished by Muncaster on these engines; the drawings were considered to be self-explanatory, at least to those readers who were sufficiently experienced to be likely to take an interest in their construction. Taken in conjunction with previous examples of design and functional details, I think that most of the essential information will be found in the drawings.

The major difference between the engine shown in Figs 35 and 36, and that in Fig. 37, is that the former was fitted with parallel motion to the piston crossheads and the latter with slide bars; this would probably, but not necessarily, be a guide to period, as the earlier engines were less likely to be fitted with sliding crossheads.

In the particular type of parallel motion illustrated, the geometry is simple and obvious; it was used on many types of engines, both horizontal and vertical, though in the latter case the ends of the radius rods were more often anchored from brackets fixed to the walls of the engine house than from columns; in a few cases, however, short rods anchored to lugs extended from the sides of the cylinders were used.

The use of a deep bedplate or plinth with the cylinder partly or completely sunk into it, in conjunction with an equally deep entablature, not only enhances the dignified appearance of the engine, but by enabling shorter columns to be used, increases the rigidity of the structure.

In the two engines shown in Figs 35 to 37 it appears that two separate plinths are employed, and also separate entablatures in the form of box girders; but I should prefer to employ a single plinth and a rectangular frame entablature; even in an engine having only one cylinder this form of construction would give maximum strength and simplify lining up.

Note that the columns are not turned to a straight taper but are slightly convex or "fish-bellied"; this is correct to architectural traditions and improves the appearance so long as it is not overdone. In the details of column pedestals and capitals on the right of Fig. 37, the exact shape of mouldings, etc., is shown, most of the dimensions being given in 32nds of an inch. The connecting rods have gib and cotter fixings for both the crankhead and crosshead bearings, the latter being forked. A belt-driven governor is fitted, operating a butterfly throttle on the steam supply line which connects to the two cylinders by a horizontal branch pipe.

When the drawings of these engines were published one or two of the details were mildly criticised by meticulous students of period steam-engine design; for instance, it was suggested that the flywheels had too great a radial depth of rim, and that four spokes should be used instead of six, also that the crankshaft should be of square section, turned only on the journals, with the flywheel and eccentric sheaves staked on.

I have no doubt that the critics were well informed, but apparently Muncaster made some concessions to simplicity in castings and machining procedure just as I do myself and if every example of a model purporting to be a true period piece were as correct as his drawings I for one should be very well satisfied. Incidentally, the drawings for Figs 35 and 36 were made by my colleague, J. N. Maskelyne, and are a fine example of engineering draughtsmanship.

* To be continued

**Fig. 37: Another double engine with sliding crossheads, showing details of columns**