ing them too far by the strap attached to the rod, as seen in the figure. The lower axis *u* has a similar apparatus, 15, 15, for the same purpose. It remains to notice how the exhausting valves are prevented from being opened by the pressure of the steam. The rods which connect the arms on the axes of the valves with the arms on the axes *t u*, it will he observed, are bent at one extremity in such a manner as that when the valves are shut, the connecting rods and the arms on the axes *t* and *u* fall into the same straight line, as is seen in the case of the upper exhausting valve in the figure. In this condition the arms of the axes *t* and « cannot act as levers **in** turning these axes round, and the valves are thus effectually locked un til released by the action of the chocks upon the handles *r s.*

*a d d* are steam-pipes, and *g g g* eduction-pipes as formerly ; *c* being the upper port of the cylinder, and *f* the bottom port ; *b* and *e* the top and bottom steam-valves, A

and » the top and bottom eduction-valves. The steam valves ft and *e* are raised or lowered by hollow rods or tubes, through which the spindles or rods of the eduction valves *h i* work freely without interference. A rod 10 joins the short levers 19, 20 of the valves *b e* together, and another rod 13 joins the levers of the valves 18 and 21 together ; so that by inserting into sockets, formed on the ends of the levers 20 21, the bars *r s,* shown by dotted lines, and by using them as lever handles, the upper steam and lower eduction-valves are opened simultaneously by the handle *r,* and by the other lever s the lower steam and upper eduction-valves are opened also stmultaneously and alternately with the former. The rods 10 and 13 are connected by the rods 11 and 12, with an apparatus of levers and weights, acting through an axis at 22, by which the valves are retained in their seats.

The last valve which we shall describe is the crown valve, or equilibrium-valve, which is in use on the Cornish engine, and has also been introduced into rotative engines by Mr Fairbairn, and Messrs Caird & Co., and which deserves to be better known than it is. Its value consists in effecting a large opening, and requiring little force to work it, while large valves of the common sort are heavy, or are so much pressed in one direction by the steam as to require great force to work them. The valve has been called the crown-valve, from the resemblance of its appearance to that of a diadem. Let there be conceived a chamber, fig. 89, out of which an aperture A leads into the cylinder, and into which a pipe S brings steam. The aperture A is surrounded by an upright ring or collar rising a few inches into the chamber, which ring is on all sides perforated by slits of considerable size, but closed at the top. The next figure, 90, represents the crown or cover of this valve, which is also a ring attached to a steel rod or spindle, by which it is raised or depressed. All round at top and bottom, the collar in the chamber and the crown-valve are ground, so as accurately to fit each other. The next diagram, fig. 91, represents the valve on its seat, and closed on all sides, so that no steam can find admittance; and fig. 92 represents it open or raised up from its seat, with steam entering freely on every side.

These valves are arranged in a manner simiIar to the common conical valves, and work in the same way, four of them being used in a single engine, instead of four conical valves as in fig. 86. The following diagram shows the valves and valvegear of a Cornish steam-engine, with the gear for working the valves either by the hand or with the pump-rod of the steam-engine. It is very perfect, and deserves the study of the intelligent en gineer. The valves are equilibrium valves, such as we have already described. Although we cannot here enter into a detailed description of the mechanism, the engineer will at once understand it from the drawing.