volve in a vertical plane, about a horizontal axis, and the control is given wholly by springs. An example is shown in fig. 100, which is the governor of the

Armington and Sims

engine referred to in

§ 197 below. Another

example is furnished

by the governor of

Brotherhood’s engine

(§ 203, fig. 128).

173. The throttle-

valve, as introduced

by Watt, was origin­

ally a disk turning on

a transverse axis across

the centre of the steam-

pipe. It is now usually

a double - beat valve

(fig. 89) or a piston-

valve. When regula­

tion is effected by

varying the cut-off, and

an expansion-valve of

the slide-valve type is used, the governor generally acts by changing the travel of the valve. Fig. 99 illustrates a common mode of doing

sion, and then, when the trip-action comes into play, it closes suddenly. The indicator diagram of a Corliss engine consequently has a nearly horizontal admission-line and a sharply defined cut-off. Generally the valves of Corliss engines are cylindrical plates turn­ing in hollow cylindrical seats which extend across the width of the cylinder. Often, however, the admission-valves are of the disk or double-beat type, and spring into their seats when the trip-gear acts. Many forms of Corliss gear have been invented by Corliss himself and by others. One of these, the Spencer Inglis@@1 trip-gear, by Messrs Hick, Hargreaves, & Co., is shown in figs. 101 and 102. A wrist-plate A, which turns on a pin on the outside of the cylinder, receives a motion of oscillation from an eccentric. It opens the cylindrical rocking-valve B by pulling the link C, which consists of two parts, connected to each other by a pair of spring clips *a, a.* Between the clips there is a rocking-cam *b,* and as the link is pulled down this cam places itself more and more athwart the link, until at a certain point it forces the clips open. Then the upper part of the link springs back and allows the valve B to close by the action of a spring in the dash-pot D. When the wrist-plate makes its return stroke the clips re-engage the upper portion of the link C, and things are ready for the next stroke. The rocking-cam *b* has its position controlled by the governor

this, by giving the expansion-valve its motion from an eccentric-rod through a link, the throw of which is varied by the displacement of the governor balls. In fig. 100, the governor acts on the main slide-valve of the engine (there being no separate expansion-valve), and the displacement of the revolving masses Μ, M changes both the throw and the angular advance of the eccentric, thereby pro­ducing a change in the steam supply similar to that produced by "notching up ” a link-motion. The eccentricity B is altered by the relative displacement of two parts C, D into which the eccentric sheave is divided. In other forms of automatic expansion-gear the lap of the valve is altered ; in others the governor acts by shifting the expansion-valve eccentric round on its shaft, and so changing its angular advance.

174. In large stationary engines the most usual plan of automati­cally regulating the expansion is to employ some form of trip-gear, the earliest type of which was introduced in 1849 by G. H. Corliss of Providence, U.S. In the Corliss system the valves which admit steam are distinct from the exhaust-valves. The latter are opened and closed by a reciprocating piece which takes its motion from an eccentric. The former are opened by a reciprocating piece, but are closed by springing back when released by a trip- or trigger-action. The trip occurs earlier or later in the piston’s stroke according to the position of the governor. The admissi on-valve is opened by the reciprocating piece with equal rapidity whether the cut-off is going to be early or late. It remains wide open during the admis-

through the link E in such a way that when the speed of the engine increases it stands more athwart the link C, and therefore

causes the clips to be released at an earlier point in the stroke. A precisely similar arrangement governs the admission of steam to the other end of the cylinder. The exhaust-valves are situated on the

@@@1 *Proc. Inst. Mech. Eng.,* 1868.