is sometimes desirable to have the regulating cock on the boiler feed-pipe, the following provision is made to render that method of regulation safe and efficient. Between the feed-pump and the boiler, there is

inserted, in connexion with the feed-pipe F, at any point

V beyond the valve of the pump V\* which prevents the return of the water into the pump, a loaded escape-valve

V ; its load W being so adjusted, that whenever the regu­lating stopcock It is turned so as to impede the passage of water towards the boiler B, the force of the feed­pump pushes the water up against the loaded valve V, and by it escapes through the return pipe *r r r* into the reservoir of supply H, again to be brought back into the pump when required for the future supply of the boiler.

Still, however, this apparatus depends in some mea­sure on the adjustment of the regulator-valve R by an attendant ; and contrivances have been invented to ren­der this also automatic. In the boiler, and on the surface of the water, is placed a weight W, with a partial counterpoise *w,* so as to rest on the surface of the water. From the point *m* a small rod passes downwards and up again, through the feed-pipe L *l* to the point V, where a conical valve or plug V opens the communication with the feed-pipe F F and the water of the boiler when it is raised, and shuts it again when depressed. Now, when the water is abundant, the weight VV floats high, and keeps down *m* and V ; and when low, W descends, and raising *m* and V, admits the required supply into the boiler without any assistance.

Where a high-pressure boiler is used for purposes in which a steam-engine is not employed, detached self- acting feeding apparatus must be employed. The fol­lowing elegant and most effective apparatus has been invented by Mr Macdowall of Johnstown, and is now in extensive use in Scotland. We have seen it in an effi­cient working state, after being employed for many years, and it only costs about £20. It is nothing less than a small steam-engine, but it is applied in a most effective and simple way to the purpose designed.

A very simple feeding apparatus, on a similar principle, was adapted some years ago to the purpose of feeding a boiler without the assistance of a steam-engine. A close vessel or reservoir is placed above the level of the boiler, and is in communication with the water in the boiler through one pipe, and with the water to be sup­plied to the boiler through another ; a third small pipe connects the steam-chest of the boiler with the top of the said reservoir. All these pipes being closed by moveable regulators or stopcocks, the attendant is first to open the steam communication, that the reservoir may be emptied of air and filled with steam, and the stopcock is then shut. In the next place, the communication with the cold water to be supplied is opened, and the reser­voir on getting cool becomes vacuous, so that the pres­sure of the atmosphere fills it with cold water, and the communication is then cut off. Lastly, the third stop­cock is opened, and the water in the reservoir having free communication with the water in the boiler, it is only necessary to open the steam-cock once more, and the water, being in equilibrium by the pressure of the steam, will run freely, by its own pressure, from its height above the boiler, into it ; and the process of alter­nately filling and emptying the boiler may be repeated as often as required by turning the cocks in this suc­cession. A simple process renders all these valves self- acting.

The reservoir, fig. 239, is a close vessel above the boiler B ; R *r* is the cold-water pipe, by which the water is obtained, and is regulated by the stopcock *r* ; F *f* is the feed-pipe for the boiler, regulated by the stopcock *f;* *Ss* is the steam-pipe opened by the stopcock *s*. In the next figure, there is a balanced float on a pivot *o,* and a slit bar *h* connecting a small slide-valve *s* with a pin on the float­bar ; *r* is a common ball valve, acting only upwards ; and in F is a valve permitting the descent of the water in the pipe F *f* and preventing its return. The latter is the self-acting form, of which the action once begun will continue indefinitely. A commanding valve being con­nected with the boiler-float, would render the play of this apparatus dependent on the requirements of the boiler itself. The reader who is acquainted with the steam-engine of Savary, will perceive at once that this reservoir, with its apparatus, is a mere Savary’s steam- engine, applied to pump water into the steam boiler; and that this application of that engine is not liable to the objection urged against it in other circumstances, namely, that the water is heated as well as raised. In this in­stance, the communication of heat is attended with no loss.

Indices of pressure and safety apparatus, form an im­portant series of appendages to a boiler. These are of four kinds; dynamometers, safety-valves, fusible plugs, and alarms.

The dynamometer, which is generally applied to measure the force of steam in a boiler, is a simple tube, bent upwards at the end, and formed sometimes of glass