This balance, by Mr Hawkins of London, consists of a cylindrical vessel open at top, on the face of which is a vertical glass tube also open above, and entering the cylin­der near its base. Within this outer case is another hollow cylindrical drum, of rather smaller diameter, on the top of which is placed the receiving scale. The inner cylinder floats on the water which the outer one contains. In pro­portion as the scale is loaded, the water rises between the cylinders and in the glass tube, beside which is a gradu­ated scale, the weight being indicated by the height which the fluid attains in the tube. The water carried off by evaporation should be replaced, as much being poured in from time to time as is required to preserve its surface at zero when the scale is empty. The continual effort of the inner cylinder to escape to the sides of the outer one is, however, a source of considerable friction ; a slight displace­ment of the cylinder from the horizontal position, or the loading of the scale more on one side of its centre than an­other, contributing to augment the evil.

This balance, by Mr Bursill of Islington, is formed in a variety of different modifications ; some of them depending on a stem or piston being caused to sink in a fluid, and others on its being caused to rise from one. It may how­ever be generally described as consisting of two cylinders of different diameter united by a connecting tube. From the top of the smaller cylinder rises a glass tube, at the side of which is a moveable index-plate, on which the gra­duations are marked. Mercury is poured to some depth into the cylinders, the smaller of which, together with the lower part of the glass tube, is then filled up with oil or coloured water, which rests on the surface of the mercury. A piston or stem, guided by a parallel movement, rises and falls in the larger mercurial holder. A counterpoise on one of the parallel rods balances the weight of the scale ; and when the latter is loaded, the displacement of mercury in the larger cylinder causes the water to rise in the tube by more perceptible gradations, and indicate the weight. The balance is likewise arranged in various combinations with the steelyard, and two contrivances (one of which may be added to the machine) are provided with the view of compensating the irregularities caused by change of tem­perature. The cylinders for the mercury are formed of pipe-clay ; and a stop-cock is placed at the head of the tube, to be opened during use to admit air, and closed afterwards to exclude dust and diminish evaporation.

This machine, by Captain Ericson of London, is repre­sented in the annexed figure. It consists of a shallow cir­cular box of cast iron, formed of two portions, an upper and under one ; the interior diameters of which are somewhat different. The lower half of the box contains a piston, the neck of which passes freely through an aperture in the bottom, and is screw­ed to the horizontal bar of the triangu­lar suspending frame. A circular piece of India rubber cloth is laid over the face of the piston, and continued through be­tween the joining rims of the iron box, the halves of which are then screwed together upon it. From the upper half of the box rises a hollow iron stem, suf­ficiently laid open to expose to view a glass tube, which it encloses in a bed of Paris plaster. Mercury is then introduced through the tube into the up­per half of the box ; and its escape being prevented by the cloth, and the distention of this resisted by the piston, the box and stem are set afloat, and are kept from capsizing by a small pin from the top of the triangular frame, which en­ters into the bore of the upright stem. The hook is con­nected with the box, and, on being loaded, draws it down, thereby causing the ring of cloth exterior to the circumfe­

rence of the piston to descend below the piston’s surface ; —in effect thus contracting the space in the box, and forcing the mercury up the tube till it indicates the weight on the graduated scale. Two safety-screws in the lower bar are adjusted to prevent the box from descending so far as to eject the mercury from the tube ; and, as in Mr Bur- sill’s, a stop-cock is placed at the mouth, to be opened dur­ing use to admit air, and shut after it to exclude dust and diminish evaporation. In this machine, the primary move­ment must necessarily be extremely confined (about the 50th or 100th part of an inch), otherwise the cloth, by be­ing overstretched, would give way. Any deviation from uniform action, however arising, and however trifling, is thus apt to occasion a magnified irregularity in the indica­tion. The admission of dust and evaporation of mercury ; the effort made by this fluid at all points to draw into globular formations, and avoid the minuter recesses of the holder ; the change of temperature, and progressive dis­tention and wrinkling of the cloth, are among the more im­mediate and least controllable sources of variation.

V. *Letter and Post-Packet Balances.*

Under this general title are enumerated such of the pre­ceding as are applied to the purpose of weighing letters; descriptions of the balances not yet noticed being sub­joined.

1. The Common, the Roman, and Danish balances ; 2. the Bent-lever, Brady’s, Dampier’s, and Lothian’s balances ; 3. Salter’s and other Spring-balances ; 4. Bursill’s balance, all as above described, are constructed also of sizes suited for letter-weights.

In this balance, which was devised for letter-weighing by Sir John Robison, secretary to the Royal Society, Edinburgh (and made by Mr Forbes there), the letter is placed on a circular ivory disc, which is supported by a steel wire, that passes freely through a small orifice in the ivory cap of a glass tube filled about a third of its depth with mercury. To the lower end of the wire is screwed a cylindrical ivory stem of larger diameter than the wire, and marked with circular graduations. This sinks in the fluid in proportion as the disc is loaded ; and the vertical movement is preserved by guide-pins, which diverge from the lower extremity of the stem. A loose ring of ivory serves the purpose of a floating pointer, while it prevents the eye being deceived by the glance of the fluid, or the images occasioned by its reflecting powers. Shortly after­wards, letter-balances of similar description were made by Messrs Miller, Dundee; Lund, Fleet Street; Osler, Bir­mingham ; and Bursill, Islington ; the three latter being re­gistered designs.

The remaining balances may properly be arranged by themselves, as a class formed to indicate periodical amounts of weight, but not their intermediate subdivisions.

In the balance by Mr Riddle of London, weights of an ounce each are rested on the successive steps of a pyra­midal support. A ring attached to one arm of a balance lifts the lowest, and proceeds to the others in their order ; the postage corresponding to the number of weights raised being indicated by a pointer. In Mr Gye’s balance three rings fixed at proper heights give support to as many weights, which are attached by a small chain to the arm of a balance, each weight being lifted in succession, and the postage known by the number of weights raised. Mr Riddle’s arrangement, however, provides for a more exact movement.

This balance, by Professor Willis, Cambridge (made by Messrs Hotzapffel), is formed of two beams joined at some distance apart, so as to form a rectangular frame, which the: figure of Poupard’s balance above described will serve to illustrate. Here also, as in that balance, the receiving scale