entered in a table or mounted on a drum which gave several correc­tions that had to be applied to the range for various causes. One great drawback to this system was that elevation was given with reference to the plane of the racers upon which the mounting moved, and as this was not always truly horizontal grave errors were intro­duced. To overcome this Colonel H. S. Watkin, C.B., introduced a hydroclinometer fixed on the trunnion. It was provided with a yard scale calculated with reference to height of site, and elevation was read by the intersection of the edge of the liquid with the graduation for the particular range. Special sights were introduced to overcome the difficulties of dis­appearing guns, large guns firing through small ports, &c. Such were the Moncrieff reflecting sights, and the “ chase sights ” for the 10-in. gun in which the rear sight, equipped with a mirror, was placed on the chase, and the fore-sight on the muzzle, &c. In the early days of B.L. guns very little change was made in the pattern of sights. Shield sights were in­troduced for disappearing mountings to admit of continuous laying for line, and a disk engraved for yards of range duly corrected for height, and called an “ elevation indicator,” replaced the index plate and reader. As in mobile artillery, the introduction of trunnionless guns brought about a revolution in laying and sights. Smokeless powder also made rapid firing a possibility and a necessity. Con­tinuous laying and telescopic sights became possible. The reduction of friction by improved mechanical arrangements, and the introduction of electric firing, enabled the layer not only to train and elevate the gun himself, but also to fire it the moment it was truly "on ” the target. The rocking-bar sight, which had been for some time in use in the navy, was introduced. In this sight both hind and fore sights are fixed on a rigid bar pivoted about the centre; the rear end is raised or depressed by a rack worked by a hand-wheel ; ranges are read from the periphery of a drum ; the fore-sight and leaf of the hind-sight are provided with small electric glow lamps for night firing. In addition to these open sights the bar also carries a sighting telescope. The advantages compared with a tangent sight are that only half the movement is required to raise the sight for any particular range; the ranges on the drum are easier to read, and if necessary can be set by another man, so that the layer need not take his eye from the telescope. The pattern of telescope used in coast defence is that designed by Dr Common. It is an erecting telescope with a field of view of 10° and a magnification of 3 diameters, and admits plenty of light. The diamond-shaped pointer is always in focus; focusing for individual eyesight is effected by turning the eye-picce, which is furnished with a scale for readjustment. A higher power glass has since been introduced for long ranges.

The improvements in gun mountings mentioned above led the way to the introduction of the automatic sight. The principle of combined sight and range-finder had long been known, and was embodied in the so-called “ Italian ” sight, but, on account of the slow rate of fire imposed by black powder, the rapidity of laying conferred by its use was of no great advantage, and it was unsuited to the imperfect mechanical arrange­ments of the gun mountings of the time. When cordite replaced black powder, and the gun sights and all in front of the gun were no longer obscured by hanging clouds of smoke, it became a de­sideratum, and, as the automatic sight, it was reintroduced by Sir G. S. Clarke, when he, as superintendent of the Royal Carriage Factory, had brought gun mountings to such a pitch of perfection that it could be usefully employed.

An automatic sight is a sight connected in such a manner with the elevating gear of the gun, that when the sight is directed on the water-line of a target at any range the gun will have the proper quadrant elevation for that range. Colonel H. S. Watkin, C.B., describes the theory of the sight thus (*Pro­ceedings R.A.I.* 1898).

*Conditions.—*The gun must be at a certain known height above sea-level—the greater the height the greater the accuracy. The racer path must be level. Let FB (fig. 19) represent a gun at height BD above water-level DC, elevated to such an angle that a shot would strike the water at C. Draw EB parallel to DC. It is clear that under these conditions, if a tangent sight AF be raised to a height F representing the elevation due to the range BC, the object C will be on the line of sight. Then ABF —angle of elevation; EFB = quadrant angle; BCD = angle of sight; EBF = ABF-ABE; and since ABE = BCD, it also equals ABF — BCD. BCD can always be cal­culated from the formula, angle of sight in minutes = (∣∏ ?

*(h=*height of gun above sea-level; R = range). An automatic sight based on the Italian sight was tried in 1878-1879. In this (see fig. 20) a rack I, fixed to the carriage, caused a pinion H on the gun to revolve. Fixed to the pinion were three cams, for high, low and mean tides. The tangent scale moved freely in a socket fixed to the gun ; its lower end rested on one of the cams, cut to a correct curve. It followed that when the gun was ele­vated or depressed, the rack caused the pinion to revolve, and the sight was thus raised or lowered to the proper height to fulfil the conditions given above ; but, as Colonel Watkin said, owing to want of level of platform and other causes it was not satisfactory.

With the introduction of quick-firing guns it was felt that the layer should have the same control over his gun as a marksman had over his rifle, and this would be afforded by a satisfactory automatic sight. The prin­ciple of the modern automatic sight is made clear in figs. 21 and 22, which show a combined rocking-bar and automatic sight.

The rocking-bar consists of a carrier *a* fixed to the cradle, a rocking­bar *d* pivoted to the carrier at *e,* a sight bar *f* carrying the rights and righting telescope. The rocking-bar is moved by a rack *g* into which a pinion on a cross-spindle *j* gears; the cross-spindle is moved by means of a worm-wheel into which a worm on the longitudinal spindle of the hand-wheel gears; one end of the cross-spindle moves the range drum 2'. The worm and hand-wheel are thrown into and out of gear by means of the clutch *t.* When the hand-wheel is thrown out of gear the sights can only be moved by means of the elevating gear of the gun. The line of sight and the elevation of the gun henceforth are inseparable. The automatic sight consists of a bent lever roller cam *m*, also secured by the bolt *e* to the carrier; the lower end of the lever carries the cam roller *n*, which is constrained to move in the cam *p* by means of the spring in the spring-box *g*; the rear end of the horizontal arm of the lever is formed into jaws *v*; the same action of the clutch *t* which releases the worm and hand-wheel forces a catch on a vertical stem *u* into the jaws of the lever, and fixes the rocking and sight bars rigidly to it. The movement of the sights can now only be effected by means of the elevating gear of the gun\* acting by means of the move­ment of the vertical arm of the bent lever, and its movement is constrained to follow the cam, which is cut in such a way that for any given elevation of the gun the sight bar is depressed to the angle of sight for the range corre­sponding to the elevation ; *b'* is a lever for making allowance for state

of tide, and *c'* is the scale on which the rise and fall in feet above and below mean sea-level are marked. In later patterns, the sight is automatic pure and simple, the lever is rigidly attached to the rocking-bar, and the range scale and gear for raising the sights dispensed with, much as shown in fig. 23. In the larger natures of