Charlemont. The length of this part is about three-fourths of a mile, and it comprises seven locks. The expense of construction, exclusive of the value of land, was 17,053*l.* 4*s.* 9*d.*; in order to diminish the expense as much as possible, the canal was contracted in width in two points, where the local impediments were considerable. The transverse dimensions of the canal are, 19 feet 6 inches at the bottom, 36 feet at the surface of the water, and 42 feet at the top of the bank,—giving a slope of 3 to 2 at the sides of the channel. The depth of water is 5 feet 6 inches in all the reaches, except the summit level, which is capable of containing 7 feet of water. The course of this portion of the line lay along the bottom of a steep ravine in a limestone rock, parallel with the channel of a mill-race adjacent to the river Blackwater; the mill-race was, therefore, diverted into the river between the first and fifth locks of the canal. Between the third and fifth locks the bed of the canal was formed by benching in the rock on one side, and embanking on the other with the materials so obtained; beyond this it was cut for a distance of nearly 350 yards through the limestone; in one place to a depth of 41 feet. The sides and bed were there lined with puddle, and protected by a facing of rubble wall. Thence, to the seventh lock, the channel was again formed by benching and embanking through a clay soil, where much caution was necessarily exercised in preventing slips at the foot of the embankment, which was subject to inundations from the Blackwater.

The masonry was all constructed of limestone from an adjacent quarry.

Two Appendices are subjoined to this Paper. The first of these gives in detail the items of expenditure for the portion of the canal described; the second contains a particular description of the locks and lock-gates, the bridges, and the earth-work. The locks are 73 feet long, 12 feet wide, and vary in rise from 6 to 11 feet. They are all constructed in ashlar masonry.

The Paper is accompanied by three Drawings, descriptive of the general plan and the details of these works, which were originally designed by Mr. Telford, and are now under the direction of Mr. Cubitt. They have been executed almost entirely under the superintendence of the author.

“An account of the permanent way of the Birmingham and Gloucester Railway.” By G. B. W. Jackson, Grad. Inst. C. E.

The object of this Railway is to afford a direct communication between the Western and the Midland Counties of England. The

Birmingham and
Gloucester
Railway.

communication describes the course of the line until it reaches Cheltenham, where it joins that which was formerly called the Great Western and Cheltenham Railway, which terminates at Gloucester. Its length is 54 miles. The prevailing inclination is 1 in 300; but on the "Lickey" incline, near Bromsgrove, the rise is 1 in 37 for a distance of $2\frac{1}{2}$ miles, in ascending which the trains are worked by American locomotives, in addition to the usual train engines. The northern portion of the Railway appears to lie on the new red sandstone; then passes to the oolitic formation, on which it terminates. In the former, the principal cuttings are through marl, some of which is exceedingly indurated, and troublesome to work. The principal strata of the latter system are blue and yellow clays. Near Cheltenham, the shifting sand frequently rendered sheet-piling necessary in passing through it. The waters of Droitwich and Cheltenham were found to possess a saline quality, which rendered them unfit for the use of the engines; that from the surface sand near Cheltenham, is, however, extremely good.

The building materials employed on this line were—the sandstones of the Lickey and Forest of Dean, the lias of Norton and Wadborough, and the oolites of Cheltenham and Bredon, together with brick, for which earth was readily procured throughout.

The cuttings and embankments, with the details of the permanent way, are severally described. The surface width is 30 feet. In the formation of embankments and cuttings, the usual methods appear to have been adopted. In the former, the slopes vary between 3 and $2\frac{1}{2}$ to 1; in the latter, between 2 and $1\frac{1}{2}$ to 1.

In cuttings, there is a system of drainage beneath the ballast, consisting of longitudinal drains on either side of the line, connected by cross spits, all of which are filled up with broken stones. The rails are supported by chairs and intermediate saddles, which rest on longitudinal balks; and these are bolted to transverse ties. On embankments, whose height exceeds five feet, the cross spits, longitudinal balks, and saddles, are all dispensed with.

The length of the bearings, the weight, dimensions, &c., of the iron and wood work, with the manner of putting them together, are then noticed.

The timber employed was, American pine, and English beech, or larch. The various prices are enumerated of the materials and labour for the permanent way, of which the average cost per mile amounted to 5,430*l*. The present condition of the line is stated to be good, and its general working to have been perfectly satisfactory, since its opening in June, 1840.

Annexed is a description of an artificial ballast obtained by burning clay, which was employed where the country did not afford natural ballast. Its expense slightly exceeds that of the ordinary ballast; blue clay burnt in kilns was found to answer the purpose best, but it does not appear to form a successful substitute for gravel. The results of experiment show it to form a very imperfect drain. The author states that he has always observed the quality of this ballast to suffer in proportion with the quantity of lime contained in its composition.

The Paper is accompanied by four Drawings, illustrating the construction of the permanent way.

“Description of a Water-pressure Engine at Illsang, in Bavaria.”

By William Lewis Baker, Grad. Inst. C.E.

The machine described in this Paper is the most perfect among nine Water-pressure Engine. engines constructed by M. de Reichenbach, for the saltworks at Illsang, in Bavaria. These important works are situated in the most southern part of the kingdom; they are supplied from a mine in the valley of Berghesgaden, and the salt-springs at Reichenhall. The salt was procured from the former in two states,—that of rock salt, which was extracted by blasting, and that of brine. The rock salt was conveyed to Reichenhall, and there underwent the purifying process. But both these methods were attended with disadvantages from the scarcity of fuel; the old method was therefore abolished, and a line of pipes of 7 inches diameter was substituted, which was laid between the two places; a distance of about 60 miles.

A series of water-pressure engines, each working a forcing pump, and being themselves worked by a head of water, were placed in convenient situations upon the line. The mine is now worked by forming cavities in the beds of salt, and filling them with water, which soon becomes strongly saturated brine; it is then pumped up, and forced through the pipes to Reichenhall, where a portion of it is retained, and the rest is sent on to Frauenstein, which is at the extremity of the line. At these places, the process of evaporation is carried on, and the salt is manufactured in the usual manner.

The Paper is illustrated by a Drawing of the Engine, showing the details of construction alluded to in the communication.