Table II. consists of two columns, *column* 1, entitled *s,* contains the reciprocal of the number expressing the slope or declivity of any pipe or canal ; that is, the quotient of its length divided by the elevation of one extremity above the other. Thus, if a canal of one mile in length be three feet higher at one end than the other, then s is 5280/3 = 1760,

*column 2* contains the logarithms of the denominators of the above-mentioned fraction, or of the different values of the quantity √*s—* L*√s +* 1∙6.

*Examples of the use of these Tables.*

*Example* 1. Water is brought into the city of Edin­burgh in several mains. One of these is a pipe of five inches diameter. The length of the pipe is 14,637 feet; and the reservoir at Comiston is forty-four feet higher than the reservoir into which it delivers the water on the Castle Hill. *Query,* The number of Scotish pints which this pipe should deliver in a minute ?

1. We have *d =* 5/4 = 1∙25 inches. The logarithm cor­responding to this *d,* being nearly the mean between the logarithms corresponding to 1∙2 and 1·3, is 2·49472.

2. We have *s* = 14637/44 or 332∙7. The logarithm corre­sponding to this in Table II. is had by taking proportional parts for the difference between the logarithms for *s* = 330 and *s* = 340, and is 148533.

3. From 2∙49472

Take 148533

Remains 1∙30939, the logarithm of 20·385 inches.

4. In column 3 of Table I. opposite to *d =* 1∙2 and *d =* 1∙3, are 0∙3 and 0∙31, of which the mean is 0∙305 inches, the correction for viscidity.

5. Therefore the velocity in inches per second is 20∙385 — 0∙305, or 20∙08.

6. To obtain the Scotish pints per minute (each contain­ing 103∙4 cubic inches), multiply the velocity by 60, and this product by 52, and this by 0∙7854 (the area of a circle whose diameter is 1), and divide by 103∙4. Or, by loga­rithms,

Add the log. of 20∙08 1∙30276

log. of 60” 1·77815

log. 52 or 25 1∙39794

log. of 0∙7854 1·89509

4·37394 Subtract tire log. of 103∙4 2·01451

Remains the log. of 228∙8 pints 2∙35943

*Example* 2. The canal mentioned in the article River, p. 270, was 18 feet broad at the surface, and 7 feet at the bottom. It was 4 feet deep, and had a declivity of 4 inches in a mile. *Query,* The mean velocity ?

1. The slant side of the canal corresponding to 4 feet deep and 5½ projection, is 6∙8 feet ; therefore the border touched by the water is 6∙8 + 7 + 6∙8 = 20∙6. The area is 4 × 18+7/2 = 50 square feet. Therefore *d* = 50/20·6 = 2·427 feet, or 29·424 inches. The logarithm corre­sponding to this in Table I. is 3·21113, and the correction for viscidity from the third column of the same table is 1·58.

2. The slope is one third of a foot in a mile, or one foot in three miles. Therefore *s* is 15840. The logarithm corresponding to this is 2·08280.

3. From 3∙2113 Subtract 2∙08280

Remains 142833 = log. of 13·438 inches.

Subtract for viscidity 1∙58

Velocity per second 11·858

This velocity is considerably smaller than what was ob­served by Mr Watt. And indeed we observe, that in the very small declivities of rivers and canals, the formula is a little different. We have made several comparisons with a formula which is essentially the same with Du Buat’s, and comes nearer in these cases. Instead of taking the hyper­bolic logarithm of *√s*+16, multiply its common loga­rithm by 2¼, or multiply it by 9, and divide the product by 4 ; and this process is vastly easier than taking the hyperbolic logarithm.

We have not however presumed to calculate tables on the authority of our own observations, thinking too respect­fully of this gentleman’s labours and observations. But this subject will ere long be fully established on a series of observations on canals of various dimensions and de­clivities, made by several eminent engineers during the execution of them. Fortunately the Chevalier du Buat’s formula is chiefly founded on observations on small canals ; and is therefore most accurate in works where it is most necessary, viz. in mill-courses, and other derivations for working machinery.

We now proceed to take notice of a few circumstances which deserve attention, in the construction of canals, in addition to those delivered in the article River.

When a canal or aqueduct is brought off from a basin or larger stream, it ought always to be widened at the en­try, if it is intended for drawing off a continued stream of water ; for such a canal has a slope, without which it can have no current. Suppose it filled to a dead level to the farther end : take away the bar, and the water immedi­ately begins to flow off at that end ; but it is some time before any motion is perceived at the head of the canal, during all which time the motion of the water is augment­ing in every part of the canal ; consequently the slope is increasing in every part, this being the sole cause of its stream. When the water at the entry *begins* to move, the slope is scarcely sensible there ; but it sensibly steepens every moment with the increase of velocity, which at last attains its maximum relative to the slope and dimensions of the whole canal ; and this regulates the depth of water in every point down the stream. When all has attained a state of permanency, the slope at the entry *remains* much greater than in any other part of the canal ; for this slope must be such as will produce a velocity sufficient for sup­plying its train. And it must be remembered, that the velocity which must be produced greatly exceeds the mean velocity corresponding to the train of the canal. Suppose that this is twenty-five inches : there must be a velocity of thirty inches at the surface, as appears by the table in the article River, p. 273. This must be produced by a real fall at the entry.

In every other part the slope is sufficient if it merely serves to give the water (already in motion) force enough for overcoming the friction and other resistances. But at the entry the water is stagnant if in a basin, or it is mov­ing past laterally if the aqueduct is derived from a river ; and having no velocity whatever in the direction of the canal, it must derive it from its slope. The water therefore which has acquired a permanent form in such an aqueduct, must necessarily take that form which exactly performs the offices requisite in its different portions. The surface re­mains horizontal in the basin, as KC (fig. 1), till it comes near the entry of the canal AB, and there it acquires the