

deficiency ; and, thinking the subject of sufficient interest to be brought before the Canadian Institute, I have embodied in the present paper, the results of my investigations. The subject may be conveniently considered under the following heads :—(1). Coal in its different aspects ; (2). Instruments and appliances ; (3). Operations.

#### § 1. DIFFERENT VARIETIES OF COAL.

Without attending to minor distinctions or points of merely local value, we may arrange all varieties of coal, so far as regards practical purposes, under the following subdivisions :

1. Anthracites.
2. Anthracitic or Dry Coals.
3. Caking or Fat Coals.
4. Cannel or Gas Coals.
5. Brown Coals or Lignites.

These varieties pass by almost insensible transitions into one another. Thus, the cannel coals are related to the lignites by the different kinds of jet, some of which are referable to the one, and some to the other subdivision. Between the caking and the cannel coals there are also various links ; whilst the anthracitic or dry coals, on the other hand—passing by excess of bitumen into the caking coals, and by a diminution of bituminous matter into the anthracites—serve to connect the first and third divisions. The typical or normal specimens of each of these five varieties, however, are sufficiently well marked.

1. *Anthracites*.—The true or normal anthracites possess a brilliant sub-metallic lustre, a degree of hardness varying from 3.0 to 3.25\*, and a specific gravity of at least 1.33. A specimen from Pennsylvania gave 1.51 ; another specimen, 1.44 ; one from the department of the Isère in France, 1.56 ; and three from Wales yielded respectively 1.33, 1.37, 1.34. It should be stated, however, that many of the Welsh specimens belong strictly to the division of anthracitic coals, rather than to that of the true anthracites. The normal anthracites exhibit also a black or grayish-black streak ; and all are good conductors of electricity. The latter character may be conveniently shewn by the method first pointed out by VonKobell. A fragment placed in a solution of sulphate of copper (blue vitriol) in contact with a strip of zinc, will become quickly coated with a deposit of metallic copper : a phenomenon not exhibited in the case of common coal. Deducting ash and moisture, true anthracites present, as a mean, the following

\* Hausmann in his *Handbuch der Mineralogie*, gives 2.5 as the extreme hardness of all coals ; but this is evidently erroneous, as many specimens, not only of anthracite, but of common and cannel coals, scratch calcareous spar.