would be made if manufacturers could learn on trustworthy authority that suitable smokeless furnaces exist; and could obtain information from users, rather than from makers, as to efficiency, cost and economy in working. It would also tend towards the same desirable end if local authorities and magistrates were provided with accurate information as to the kinds of manufacturing processes in which it had been proved that the production of smoke can be economically prevented. To this end the committee set about, firstly, collecting and arranging the results of past experience; secondly, making examinations and tests by the aid of experts. The report under notice embodies the chief results of their labors.

We have here said engineers know "that factory smoke is a preventable evil," but that is a fact which is not always acknowledged willingly. Reference is made in the report to the theory—which is still largely held, and is a favorite argument with some writers in the press—that if there is not black smoke at a chimney top, carbon monoxide, a highly poisonous gas, must be generated. Mr. Fletcher has investigated this matter, and it is only necessary here to say that he refutes the argument. His reasons for negativing the statement are given in the report. It is also unnecessary for us to follow the report in the explanation of the phenomena which occur in the burning of coal in a boiler furnace. Our readers are aware that, in the words of the report, "the problem to be solved is that of effecting the complete combustion of coal with a minimum of air." Excess of air is heat carried to waste; deficiency in air leads to smoke, although the presence of smoke is not necessarily a proof of deficient air supply. Ideal stoking practice would be reached if the exact quantity of air required for combustion of the fuel were admitted to the furnace, and the whole of this air were properly used. Such a perfect balance is, of course, not to be secured, and practically an excess of air must be admitted.

The committee decided in making special tests to use both the chemical and mechanical methods, setting one as a check against the other. The chemical tests included examination for temperature and analyses of chimney gases. The mechanical tests were of the nature of discovering the performance of the boiler or engines, and comparing the coal burnt with the work done. Of course, these were combined with observations of chimneys and records of smoke emitted. It was further decided the tests should be carried out under the ordinary conditions of factory working, those makers who might be interested in apparatus to be tried not being informed, so that the machinery would not be specially prepared, and the working being of the nature of a *tour de force.*

The information collected is presented in five elaborate and extensive tables, which will require close study in order to afford instruction to the manufacturer. Values are given for smoke emitted. Three degrees of density were taken as standards, namely, dense, medium, and faint. From whole-day observations made at Bolton and Oldham, it appeared that with hand firing and admitting air at the front, at the back, or at both back and front of the furnaces, the average duration of smoke, in 12 examples of each process, was 104, 81, and 82 minutes respectively during 10 hours. With four kinds of sprinkling stokers the average duration of smoke per 10 hours was respectively 97, 103, 117, and 108 minutes. With 21 examples of coking stokers, the average duration of smoke was only 16 minutes per day of 10 hours. These latter do not come far short of standing first in power and economy, whilst six of them are far the best in the competition, both by the water evaporated per pound of carbon value and by the proportion of carbonic acid in the waste gases. "This," the report adds, "shows that the action of the machine was attended by the letting in of less unnecessary and heat-absorbing air than any of the other machines or systems." As before stated, very full details of these tests are given in the tables, and to these we refer our readers.

In regard to hand-firing, the report has some pregnant remarks. The two best examples of smokeless hand-firing gave 10 and 17 minutes' smoke, but the same results do not appear to have been attained when the firemen were not aware that their chimneys were being observed; the records going up to 86 and 40 minutes respectively. In other cases bad results are attributed to want of skill or care on the part of the firemen.

Returning to the mechanical stokers, we find that one only gave four minutes' smoke per day of 10 hours, as an average of two days, with three boilers burning 72 tons of coal per week. In other cases two and three minutes are recorded. In the case of an alkali works, where 11 boilers with a coking stoker discharged into one chimney, there was only 2½ minutes faint smoke per hour.

It is needless to give further isolated details here, and we will conclude with one or two expressions of opinion from the report. Firstly, there is a quotation from the Glasgow branch: "The committee is of opinion that whilst future experiments and inventions may be the means of introducing new and better methods of treatment in the combustion of fuel, enough is known at present to enable steam users to work their boilers with a fair degree of economy and practically without smoke." The Sheffield committee say: "While it is certain that smoke may be almost entirely and completely prevented from steam-boiler chimneys, the conditions of working are so varied that no single arrangement can be expected to meet every individual case, and, further, whatever device is applied to a boiler to prevent smoke, its success will, in a great measure, depend upon intelligent handling and management." The main committee for themselves say: "A manufacturing district may be free from manufacturing smoke—at least from steam boilers, with which alone the committee have concerned themselves—and as to the means by which it may be freed, this report contains ample information."

For THE CANADIAN ENGINEER.

DYNAMOS AND MOTORS—MAINTENANCE AND CONSTRUCTION.

BY J. B. HALL, E.E.

As a great many commutators are constructed a slight blow on the surface will produce a flat, *a*, Fig. 1, which can only be removed by turning off the surface in a lathe. An excellent method of prevention is to leave the space below segments *b*, Fig. 1, vacant, and after assembling drill two holes, *c*, Fig. 1, in the sleeve *d* and washer *e*, and after warming the commutator to about 212° Fahr., pour molten sulphur in one hole until it is full, jarring the commutator to cause adhering air bubbles to escape. Thus the possibility of developing a flat is minimized; in fact some prepared thus have been