The shoot (*a*) receives the pulverised coal. It is closed on the bottom by the bent steel plate (*c*), adjustable by the screw (*b*) and the loose flap (*d*). A fixed plate (*e*) relieves the flap (*d*) from the pressure of the powdered coal. (*f*) is a brush, the bristles consisting of steel wires. It carries in the middle the hammer (*g*), which strikes at every revolution of the brush against the nose (*h*) of the steel flap (*d*), and moves the same slightly back from the plate (*c*). As this latter is kept by the screw (*b*) in its position, a slot-like opening is made with each revolution of the brush, through which the powdered coal falls upon the brush. The coal is caught by steel-wire bristles and driven into the combustion-chamber (*k*). As soon as the hammer (*g*) has passed the nose (*h*), the flap (*d*), owing to its elasticity, strikes back against the plate (*c*). In this manner the coal-dust is kept agitated in the shoot, and consequently an absolutely regular feeding-down takes place. The combustion-chamber (*k*) is formed in the simplest manner; for example, in a flue boiler by lining the flue with firebricks for a length of 5 ft. to 9 ft., and providing a fire bridge at the end of this lining. The brick walls (*g*) attain in a very short time the temperature necessary for constant ignition of coal-dust. The first ignition of the coal-dust is effected without any difficulty by a small wood fire or by burning a little old waste soaked in petroleum. A boiler standing all night has the fire properly started in five minutes. The necessary amount of air is introduced to the furnace in the directions indicated by the arrows (*l*, *m*, and *n*), and it is quite sufficient to regulate the admission by the sliding plate (*o*). The amount of coal-dust is regulated during the firing by the screw (*b*). The further the screw is pushed back the wider becomes the distance between (*c*) and (*d*). During firing, only the regulation of the plate (*o*) and the screw (*b*) is necessary, and the only work for the fireman is the removal every ten hours of the ash-dust which, as already explained, lies in a molten state at the bottom of the combustion-chamber, but this operation does not affect the working of the furnace. One man can attend a battery of twelve boilers or even more. For driving the firing-apparatus mechanical power is necessary equal to only one-tenth of a horse-power.

Some of the advantages of the apparatus are here enumerated:—

(1.) Combustible materials and fuels of the lowest quality can be burnt. Earthy lignite, mineral coal, anthracite, or charcoal can be used with the greatest effect without any change in the apparatus. The highest percentage of ash in the coal is no hindrance in the case of the coal-dust firing.

(2.) Absolute smokelessness. It is possible, without trouble, to work with perfect absence of smoke and yet to attain an amount of carbonic acid in the waste gases nearly equal to the theoretical (calculated) maximum.

(3.) The highest calorific efficiency is obtainable from the fuel, which can be only partially attained with a grate furnace, and even with the extra cost of pulverising the coal there is still a very great saving of fuel.

(4.) Minimum wear-and-tear of the boilers, because the firing is continuous. There is no opening of the fire-doors.

What is claimed for the system has been abundantly proved by tests. The economic value of the apparatus is beyond question. Its perfect combustion produces the highest calorific efficiency from the fuel, which is impossible with ordinary hand-stoked furnaces because of the accumulation of huge clinkers and opening of the furnace-door to extract these, and the consequent inrush of excessive oxygen, which prevents perfect combustion. If the highest calorific efficiency is attained a higher pressure of steam must result. The remarkable superiority of the Schwartzkopff system is shown in the fact that better results are obtainable by it from the worst kind of fuel than from the very best coal with ordinary hand stoking. No steam-user would think of purchasing common "dant" or slack, costing only 4s. a ton, for firing his furnaces. The cheapest slack he buys is 6s. a ton, and though he has thus to pay 33⅓ per cent. more for his fuel he has to be content with at least 30 per cent. worse results than obtained by the Schwartzkopff system with the cheaper fuel. Therefore, calculating the cost of milling at 1s. per ton, which brings the price of the slack to 5s., there is still a saving in the cost of fuel of 20 per cent., plus 30 per cent. better results. The benefits and advantages do not end here, as labour, which is a considerable item of expense in the hand-stoking system, is reduced to a minimum. A large firm adopting the Schwartzkopff system would therefore effect a saving which in a very short period would cover the cost of laying down the necessary plant both for milling and stoking. The apparatus can be fitted on ships, as well as for smelting, reheating furnaces, rotary furnaces, salt-pans—in fact, for all kinds of furnaces, whether for generating steam or heating.

Tests have been made with water-tube and Lancashire boilers. The following is the result of the comparative tests between hand firing and the Schwartzkopff system recently made with a Lancashire boiler. Boiler conditions were the same in every way when fired by both systems, but the fuel used for the hand firing was slack of good quality (market price 6s. per ton), while the fuel used for the Schwartzkopff was the inferior slack, costing 4s. per ton, which had passed through the ⅜ in. mesh screen at the pit:—

Water evaporated by Schwartzkopff system per pound of fuel from and at 212° Fahr.	8·10
Hand-firing	6·68
Difference in favour of coal-dust firing	1·42 = 21·25 per cent.

It is reasonable to suppose that, working under ordinary conditions, the 21·25-per-cent. saving could still be increased on account of loss through fire-bars, &c., which was prevented during the hand-fire tests by burning the ash over again. It is also reasonable to suppose that if the calculation was worked out at per pound of combustible the percentage in favour of dust-firing would still be increased.