

per eight hours (this crusher has been in use for six years). The crushed material is then elevated into hoppers, from whence it is carried by conveyor, for calcination and removal of the water present, to a rotary drier, being a slowly revolving cylinder 45 ft. in length by 4 ft. 6 in. diameter, having a furnace at one end and a chimney-stack at the other. The limestone and marl are dried separately. The temperature in the drier is about 500° C.

The material is then elevated into two funnel-shaped storage hoppers, from which it is drawn off and mixed (by weighing) into trucks, the proportions being—marl 20 to 25 per cent., the balance limestone. It then passes for preliminary grinding to a Newell's "Lion" ball mill, where it is reduced to a grade of  $\frac{5}{8}$  in. (there is considerable wear on the grinding-plates and screen), from whence it is fed for finer grinding to two Fuller-Lehigh pulverizing-mills, which reduce it to the fineness previously stated.

#### THE BURNING OF THE RAW MATERIALS TO INCIPIENT FUSION (CHEMICAL PROCESS).

The third step is the rotary kiln, where the chemical combination of the lime with the silica and alumina of the clay takes place, producing Portland-cement clinker. The rotary kiln in use is 125 ft. in length by 8 ft. diameter; it is revolved by geared wheels about once per 60 to 75 seconds; it is lined with Brunner firebrick (which lining lasts about twelve months). The kiln is inclined about 1 in 25, so that material fed into one end will move by gravity to the discharge end. Fine West Coast bituminous coaldust, 95 per cent. of which is ground by tube mill from slack to a fineness of 100 by 100 mesh, is blown from a tube into the lower end of the revolving kiln; a proportion of about 28 to 38 per cent. of coal in weight to that of the manufactured cement is used. The clinker is discharged from a hooded open end, through which the coal-feed pipe passes; this hood closes the end of the kiln. The temperature in the kiln is about 1,200° C.

This intense flame is projected on the raw material. As the material travels down the kiln chemical changes, brought about by the terrific heat, take place, viz.: (1.) Dissociation of combined water and loss of organic matter in the clay; (2.) dissociation of sulphates and alkalis; (3.) dissociation of carbonates; (4.) chemical combination (incipient fusion) of silica, alumina, and lime in the hot zone of the kiln.

#### COOLING AND GRINDING THE CLINKER (MECHANICAL PROCESS).

The fourth and final step is the cooling and grinding of the clinker. The clinker in grade to pass through a 3 in. screen is conveyed from the kiln to a storage dump, during which transport it is cooled to about 200° F. Gypsum (from Australia), in proportion of  $1\frac{1}{2}$  to 3 per cent. according to requirements, is now added to regulate the setting of the cement. The final step of grinding the clinker is now entered upon. The machinery and power required for this are very closely the same as that required for grinding the hard raw materials for the same output, the clinker being much harder to pulverize, although for every ton of cement clinker 1.5 tons of raw materials are required. After passing through the preliminary grinding-mills and ball mills the article is finished by being ground in tube mills, 86 per cent. being to a fineness of 180 by 180 mesh, or 32,400 apertures to a square inch. The tube mills resemble those in operation on our goldfields; they are lined with flint bricks, and flint pebbles are used therein. Electrical power (alternating current) generated upon the works is used for the whole process.

#### THE FINISHED ARTICLE.

The finished article is then elevated into hoppers, and automatically weighed and bagged; the bags are sewn by hand. The bags contain 123 $\frac{1}{2}$  lb. of cement, being 18 bags per ton.

For the shipment of their product the company has constructed at Tarakohe a substantial ferro-concrete wharf, at which vessels carrying 1,400 tons or more have been loaded. This wharf is situated about five miles east of the Waitapu (Takaka) Wharf.

#### OUTLINE OF PROCESS.

