The mill having a diameter of 3ft. 6in. has a crushing-capacity of 12 tons of quartz per day of twenty-four hours. It weighs 2 tons 3 cwt., and requires four-horse power to work it at the proper speed, which is eighty-five revolutions per minute.

The larger-sized mill has a crushing-capacity of 20 tons of quartz per twenty-four hours, its total weight being 4½ tons. The power required to work it is equal to six-horse, which drives it at sixty-five revolutions per minute.

Before commencing to describe this quartz-mill it will be necessary to mention that a rock-breaker is required where one of these mills is used. The ore is first put through the rock-breaker and reduced to about 1in. in diameter, thence taken into a Challenge ore-feeder (see Fig. 1*a*), which feeds the quartz-mill automatically. This ore-feeder has a circular plate on the bottom, set on a slight incline towards the mill, on the under side of which there is a toothed wheel which is worked by a pinion having a very small rack-motion, which moves the circular plate about ¼in. at a time. This motion is sufficient to feed the ore as fast as the mill can crush it.

The mill itself consists of a circular cast-iron basin 3ft. 6in. in depth in the inside. There is a circular die-ring, against which the horizontal rollers are pressed with the centrifugal motion of the pan as it revolves. There are three rollers in the smallest mill, and four in the largest size. These are suspended by a cross-arm and shaft to the top side of the pan. The cross-arm on the top of the vertical shaft of each roller has bearings turned on each end, and these are fitted into plummer-blocks, so that the whole is suspended, and all allow the vertical shaft and horizontal roller to fly against the side of the pan when it is set in motion. Indeed, it is somewhat on the same principle as the governor of a steam-engine, only, instead of the rollers being balls, they are about 18in. in diameter, with a 6½in. face, each roller having a steel tire about 3in. in thickness, which can be easily replaced as the tires get worn out. The rollers are suspended about ½in. above the bottom of the pan, so that they never come in contact with the mercury which is placed in the bottom to collect the free gold. By this arrangement the mercury is not liable to get floured.

The die-ring is placed at the bottom, and directly above this the gratings are fixed, one in front and one at each side, so that it may be said there is a grating round the pan for about one-third of its circumference. The gratings are 8in. in height, and those that were used at the mill worked in the Exhibition had about No. 15½ mesh, or 240 holes per square inch.

As soon as the pan is set in motion the rollers fly outwards like the governors of a steam-engine, and revolve with the pressure against the die; and as the ore is fed into the mill it is impelled by centrifugal motion towards the outside of the pan, and is ground up between the rollers and the die-ring, while the water and pulverised material pass through the screens on to an inclined table, which is covered with electro-plated copper plates, and after passing over this table the material goes into a well in which the end of a steam-ejector is placed. This ejector lifts the water and tailings into a hopper which feeds a Frue vanner, and there all the concentrates are saved. Quicksilver is used in this mill to collect all the free gold; but, as before described, the rollers do not come in contact with the silver, but are suspended directly above it. This is done to prevent the mercury from being broken up, which causes flouring.

This mill is highly spoken of in the *Mining and Scientific Press*, of San Francisco, and has been in general use on the Pacific Slope for several years. The cost of these mills landed in Auckland is as follows: Small size, 3ft. 6in. in diameter, £250; large size, 5ft. in diameter, £375. The former size has a crushing-capacity of 72 tons, and the latter of 120 tons per week—that is, working night and day.

The following are the advantages that the manufacturers claim for this mill; and these advantages are bound to be acknowledged to a great extent by any one conversant with quartz-crushing machinery:—

(1.) The cost of a mill of the same capacity is not more than half that of stamps.

(2.) The cost of transport about one-fourth that of stamps.

(3.) The cost of erection about one-tenth that of stamps.

(4.) These mills only require about one-third the power of that of stamps of equal crushing-capacity.

(5.) The wear and tear is much less than that of stamps, and the wearing-parts are easily duplicated.

(6.) This mill leaves the pulp in a better condition for concentrating than the stamp-mill, and it is also a better amalgamator, as it saves about nine-tenths of the gold in the mill; and its simplicity of construction obviates the need of mechanical skill. The rotary method of crushing the ore so granulates the pulp—which is discharged the moment it is crushed—that a complete concentration of ore containing sulphurets is rendered most easy.

The superintendent of the Paradise Valley Mining Company (Mr. J. V. McCurdy) states that his company used three of the small-sized mills, 3ft. 6in. in diameter. During twelve months these mills crushed 7,631 tons of hard silver-ore at a cost of 3s. per ton, including all wear and tear of machinery. Mr. T. G. Morgan, Superintendent of the Pittsburgh Mill and Mining Company, states that his company has been running two of these mills for two years, and find them superior to the stamp-mills, the cost of crushing hard quartz being a trifle more than one-half that by stamps. The wearing-parts are easily and speedily removed when worn out, and replaced with new ones—thereby keeping the mill almost constantly in motion. He also states that from 80 to 85 per cent. of the metals in the ore is saved in the mill; which proves it to be a very good amalgamator. The mills run at a speed of from eighty to eighty-five revolutions per minute, and crush, on an average, 25 tons in twenty-four hours through a No. 8 slot-screen, which is equal to a No. 40 wire-screen; and a twenty-horse-power engine can work four of these mills, besides a No. 1 Dodge rock-breaker.

Annexed is a sketch of the Huntingdon quartz-mill, which will enable the above description to be more clearly understood. (See Fig. 1.)