proved at Granya, Howqua, Malmsbury, Waukaringa, South Australia; Mount Shamrock, Queensland; Swift's Creek, Omeo, and other places.

"Each machine weighs about three tons, is very portable, and is inexpensive to erect. Notwithstanding the great efficiency of this machine, a small proportion of gold and silver is lost, varying with the different classes of ore. In order to save this it is strongly recommended that the Watson and Denny concentrator be afterwards used, thereby obtaining nearly all the valuable metals at an insignificant cost, the concentrates after roasting being re-treated by another grinder and amalgamator similar to those previously mentioned.

"Therefore the complete Watson and Denny process consists of—(1) Grinding the crushed ores and tailings in bulk to a certain degree of fineness, and obtaining therefrom the greater portion of the gold and silver; (2) concentrating the ground ores in the concentrator, then roasting concentrates in portable furnace; (3) roasting and regrinding the concentrates to the finest possible slime, from which the gold and silver is obtained, with the exception of a very small percentage.

"The whole of this process being one continuous operation, and the machines automatic, no handling of the stuff is required from the time it is fed into the battery-boxes until it issues from the last machine as valueless slime, except that necessary for handling the small percentage of concentrates. It will, however, be understood that in most instances the first operation by the grinder and amalgamator suffices to extract nearly all the valuable metals, and therefore the concentrator, furnace, and additional grinder and amalgamator would not be absolutely necessary in all classes of ores.

"The machines are provided with locks and keys, to thoroughly secure the safety of the amalgam until the cleaning-up, which may be every week, fortnight, or month, this operation taking about an hour for each machine. A full description of the method of working these machines will be supplied to purchasers, so that any ordinary battery-man can attend to them."

General Description.—The main body of this machine is a wide circular iron casting about 5½ft. in diameter and 2½ft. deep, the bottom of which is flat near the periphery, but rises slightly towards the centre. A false bottom, consisting of corrugated segments, is placed in a horizontal position above the true bottom, the inner end resting on the upper part of the true bottom, while the outer end rests on supports. These segments have projections at both ends which fit into places provided for their reception to prevent them from shifting. There is an elongated wedge-shaped space left between the lower segments and the true bottom; this is partly filled with quicksilver when working, and it is here that the process of amalgamation takes place. The upper grinding-segments are also provided with annular corrugations that fit into those of the lower segments, so that when set up there are radial spaces between each piece. The upper segments are attached to the carrying-plate, which communicates a rotary motion to them from the driver. Between these grinding-surfaces the ore is ground to an almost impalpable state; and the currents formed by the rotary motion, the inflow and outflow of the material, together with the effect of the guide-blades, causes the reduced material to pass numerous times against and into the quicksilver before escaping into the classifier, prior to being conducted away. As the quicksilver is kept in motion by the produced currents it is constantly presenting fresh surfaces to the material. The gearing for driving purposes is placed under the machine, being thereby protected from dust, and there is no danger of oil from the bearings getting into the machine to sicken the quicksilver.

Molloy's Hydrogen-amalgam Pan.

Some of these pans have been erected in the North Island of New Zealand, but they have not been so successful in the treatment of the ore as contemplated at first outset. However, several improvements have been made, and possibly they may now come into more general use. Experiments with these pans were made in London, and from the description of them and their action on the mercury one might expect that they would be invaluable amalgamating-machines. Annexed is a sketch showing their construction (see Fig. 24). The description appeared in the London *Times*.

"The difficulty, or, rather, the impossibility, of obtaining by mercurial amalgamation anything like a full yield of gold from what are known as refractory ores has long been recognised, and has led to the appliance of various remedies from time to time. The difficulty arises from the circumstance that in some ores the gold is variously associated with sulphur, iron-oxide, arsenic, antimony, or zinc; and the presence of any of these ingredients destroys the 'quickness' of the mercury, and so renders it sluggish, and incapable of seizing and retaining the atoms of gold. The most recent invention in connection with the present subject is the hydrogen-amalgam process, which has been invented by Mr. B. C. Molloy, M.P., the working of which on a practical scale we recently witnessed at the laboratory of Messrs. Johnson and Sons, of Cross Street, Finsbury, assayers to the Bank of England. The principle involved in this process is the well-known one that when gold is brought into absolute contact with clean or 'quick' mercury the gold is absorbed by and retained in the mercury, from which it is afterwards retorted. In cases where refractory ores have to be dealt with, they cause the mercury to 'sicken'—that is, to become coated with an oxide which lies like a sheet of paper on the surface of the body of the mercury preventing contact between the particles of gold and the clean portion of the mercury. This sick mercury also powders away, or, as it is termed, 'flours,' so that the floured liquid metal is carried away and lost, leaving fresh surfaces to be attacked by the injurious ingredients in the ore. The result is, therefore, that not only is the gold not captured, but mercury is lost and carried away in the tailings. With some of the less-refractory ores the loss of mercury is from 2lb. to 6lb. per ton of ore treated; while in some other cases the loss is much greater. Owing to this difficulty in the treatment of auriferous ores, it has been estimated that the average of 40 per cent. of the gold contained in the ores treated is annually lost. The object of the hydrogen-amalgam process is to save this enormous loss of gold and mercury, and, according to authoritative reports, this object is completely and successfully attained.