47: Kelsey centrifugal jig – 1980s research in Australia

Figure 101. KELSEY CENTRIFUGAL JIG
A model J1800 Kelsey centrifugal jig. (photo: courtesy of Dale Henderson of makers Roche Mining – www.rochemt.com.au)

The Kelsey centrifugal jig was invented by Christopher G. Kelsey of Australia and patented in Australia in 1985 (PH9037, PG0122) and 1990 in the USA (US #4,898,666). The first commercial sale was of a lab-sized machine in 1989. Geo Logics Inc developed the device, and automatic screen cleaning was introduced in 1999. In 2001 Geo Logics was bought by Roche Mining who continues to make the jig (www.rochemt.com.au).

The Kelsey centrifugal jig maximises its effectiveness and efficiency by combining the pulsation principle of a jig with the high apparent gravitational field of a centrifuge.

The main models and operating variables are:

- J200 KCJ – lab test unit, 15-100 kg/hour of solids;
- J1300 MkII KCJ – smallest commercial unit, 2-30 tons/hour;
- J1800 KCJ – largest commercial unit, 5-60 tons/hour.
- feed-related variables – feed type; feed density; feed rate; feed size; and density difference between minerals.
- jig set-up variables – screen aperture size; ragging type, ragging density, ragging size distribution and depth.
- jig control variables – rotational speed (induced gravity field); pulsing frequency; pulse amplitude (distance travelled during each pulse stroke); and rate of adding hutch water.

Operation

The slurry feed is 25-40% solids and enters a chamber consisting of a circular screen mounted vertically, plus a particle bed. The chamber rotates at 30-45 rpm to create a force of up to 50g. Water injected into the inner chamber subjects the slurry to a jig-like pulsation force to alternately expand and compress the particle bed. This stimulates denser minerals to move towards the bed and so be collected after passing through the screen into an inner chamber and discharged via small holes. Lighter particles overflow the chamber as tailings.

According to the maker, *"the ability to change the apparent gravitational field, up to 50 times gravity, results in a major improvement in separation efficiency, particularly of very fine minerals, by significantly reducing the effect of forces that hinder fine particle separation."*

Hindered settling is accentuated by the centrifugal force together with the pulsing of the ragging bed. The pulsing is via pulse arms connected to pads to work against the jig's flexible diaphragm. *"Water contained within the concentrate hutches presses against the diaphragm, at a frequency and amplitude set by the operator, thus dilating the ragging bed. The level of dilation impacts on the amount of material able to pass to concentrate."* The pulsed shockwaves have two effects:

- dilating the ragging bed to allow minerals to enter it; and
- accentuating differences in acceleration between particles of different density. Separation of particles of similar size and shape but different density slows at their terminal velocity. The shockwaves repeatedly stop the particles, limiting their time at terminal velocity to maintain a high rate of separation.

Adoption by placer gold miners

The Kelsey centrifugal jig is used to recover hardrock gold, platinum, cassiterite, monazite sand, coal etc [117-122]. It performed well with fine flat placer gold from offshore Alaska [122] but is not seen in placer gold mines.

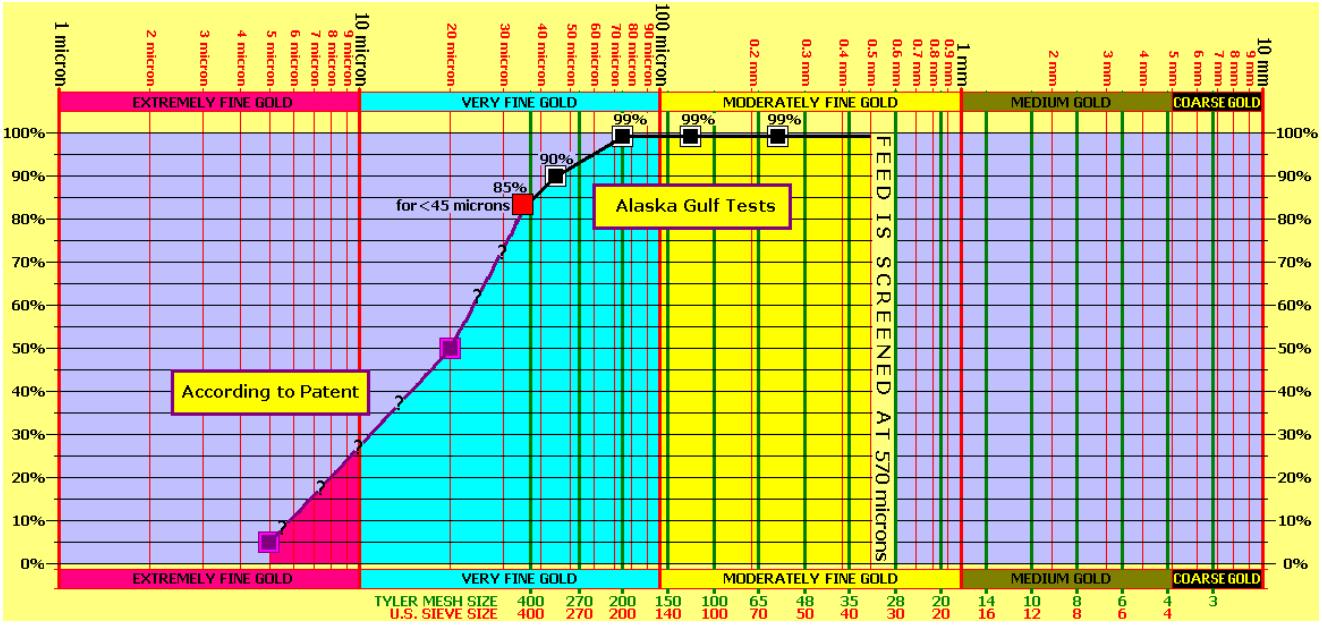

Figure 102. GOLD RECOVERY BY KELSEY CENTRIFUGAL JIG
Recovery of placer gold by Kelsey centrifugal jig, according to the patent and test on Alaska Gulf placers [122]. *(compiler: Robin Grayson)*