IHC Mining

Gravity separation equipment for gold mining

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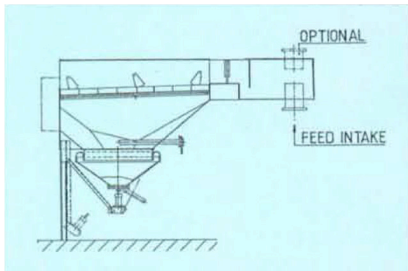
IHC Holland have been involved in the design and manufacture of mining equipment since the end of the last century. Most of this equipment is used in alluvial mining projects all over the world. In the early days, most of the dredgers built for mining were of the bucket type, with sluice boxes, and these were used for gold mining operations. But gradually the emphasis changed to alluvial tin mining, With the fixed, low gold price between 1945 and 1973, hardly any equipment was sold for gold mining projects. Alluvial tin mining, however, continued to develop and bucket dredgers with integrated treatment installations were built in large numbers.

More and more attention was given to the efficiency of the treatment installations, and this ultimately led to the development of the IHC These jigs were first used on the modern bucket dredgers built for use in alluvial tin projects, and after 1973 again for alluvial gold operations.
In the early Eighties it was realized that the highly efficient IHC treatment installations on board bucket dredgers, could be used to advantage in other mining applications. IHC developed skidmounted plants for onshore operations and a pontoon-mounted version to work in conjunction with backhoe, grab, cutter or wheel dredgers. With the decline of the tin market after 1985, these new concepts have come to be used primarily in gold mining projects. These not only include alluvial mining, but also other applications like hardrock gold mining and the recovery of gold as a by-product of sand and gravel winning. equipment, and highlight some of the specific operational parameters for these applications.

IHC Holland jigs
The basic design of IHC Holland jigs was developed in the late Sixties and combines the trapezoidal shape with the IHC sawtooth drive characteristic, i.e. a rapid upward stroke followed by a slow downward movement of the pulsator.
Besides higher recovery rates, especially in the small particle size ranges, this concept improves feed distribution, requires less construction space, water and power, and reduces operational costs.
The present range is based on a modular design consisting of separated cells as shown in Figs. 1 and 2.

For gold processing, each cell or module will as a rule be able to process 32 ton/hr of dry solids.



Depending on the required capacity, modules can be combined, the maximum number, twelve, forming a circular jig. If additional capacity is required. further jigs, each consisting of a number of modules, can be installed, For smaller capacities, a mini-module jig and a number of small rectangular jigs are available.

The use of jigs in gold separation
In general, jigs are well suited to use in gold separation pro-cesses. The high specific density of gold is an important parameter in assuring high efficiency in gravity separation, even for smaller particle size ranges.
The thick bed characteristics of the jig, as compared to thin flowing film concentrators such as spirals and shaking tables, guarantees a stable operation and makes the jig less sensitive to fluctuations in feed capacity and material parameters.

Furthermore, due to its ductile character, gold tends to form long flat particles, giving problems in the separation process when using thin flowing film concentrators.
This makes the jig superior to other gravity methods, particularly for rougher duty/primary concentration, or as preconcentrator where feed fluctuations cannot be avoided.

TYPES OF IHC HIGH-RECOVERY JIGS

Type designation	micro	super micro	mini-mod.	1 mod.	2 mod.	3 mod.	4 mod.	5 mod.	6 mod.
Total jig bed area (m²)	0.25	0.56	1.15	3.2	6.4	9.6	12.8	16	19.2
(sq ft)	2.7	6	12.4	34.4	68.9	103.3	137.8	172.2	206.7
Cells per jig	1	1	1	1	2	3	4	5	6
Power installed (kW)	1.5	1.5	1.5	2.2	4.4	5.5	5.5	7.5	7.5
* Capacity range (m³/hr)	1-2	2-4	6.0-15	15-23	30-46	46-69	60-92	75-115	92-138
(cu yd/hr)	1.5-3	3-5	8-20	20-30	40-60	60-90	80-120	100-150	120-180

Type designation	7 mod.	8 mod.	9 mod.	10 mod.	11 mod.	12 mod.	RH-1	RH-2	RH-3
Total jig bed area (m²)	22.4	25.6	28.8	32	35.2	38.4	1.15	2.30	3.45
(sq ft)	241.1	275.5	310	344.5	378.9	413.3	12.4	24.8	37.1
Cells per jig	7	8	9	10	11	12	1	2	3
Power installed (kW)	7.5	7.5	9.2	9.2	9.2	9.2	2.2	4.4	6.6
* Capacity range (m³/hr)	105-161	120-184	138-207	150-230	165-253	180-267	6.0-15	8.0-18	10-20
(cu yd/hr)	140-210	160-240	180-270	200-300	220-330	240-350	8.0-20	10.5-23	13-26

* Capacity in solids througput per hour depends on specific gravity of minerals to be separated, amount of fines, pulp dilution, required recovery and ratio of concentration, etc.
Please consult IHC Holland for your specific problem.

In the following sections, various uses of IHC jigs in goldmining operations will be examined. Every operation depends on the operating parameters encountered, not only in terms of capacity, but also of flowsheet layout, efficiency and operational control.

IHC jigs in alluvial gold mining

The treatment installation shown in Fig. 3 was designed and built for an alluvial gold mining operation in West Africa and consists of a scrubber/ screening unit and a separate jig plant with six modules as the primary stage.

The feed material is fed into the scrubber/screen drum assisted by monitors, thoroughly washed and screened off at 9.5 mm. The oversize is discharged by belt conveyors and the undersize pumped to the jig installation.

The jig feed material is processed through two cyclones to get rid of the slimy material. This is necessary as clay contents of over 15% reduce the efficiency of the jigs. For this kind of alluvial gold operations, three jig stages are normally used, with the tailings of the primary stage being discharged, as can be seen in the flowsheet shown in Fig. 4.

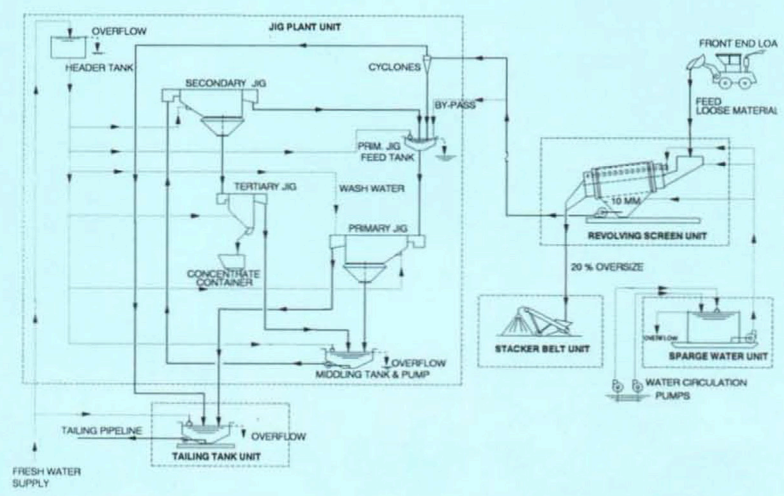
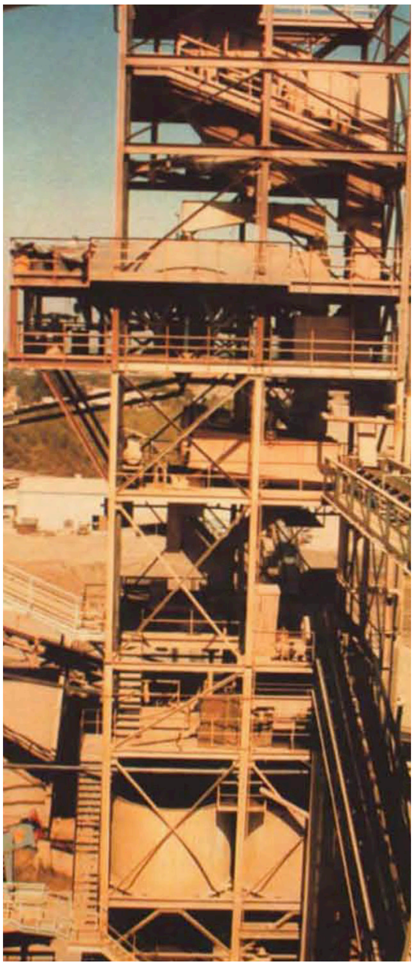


Fig. 4

The primary stage concentrate is fed into the secondary jig stage, of which the tailings are recirculated via the primary stage. The secondary stage concentrate is further upgraded in the tertiary jig stage, producing the final con-centrate. Tailings from the tertiary stage are also recirculated via the secondary stage.



The purpose of the primary jig is to get the highest possible recovery, while the secondary and tertiary jigs are used as clean-up stages to increase the quality of the concentrate.

Fig. 5 gives a detailed view of the six-module jig plant with cyclones. Even when treating material with high clay content, recovery rates of over 96% have been measured on gold particles down to 50 pm.

Using IHC jigs in three stages enables ratios of concentration between 2000 and 4000 to be achieved.

IHC jigs for gold recovery in sand and gravel operations

The next example of the use of IHC jigs is shown in Fig. 6. This picture shows the process tower of a sand and gravel operation in the U.S.A. The deposit contains alluvial gold, which is recovered as a by-product. The gold used to be recovered by two sluice boxes, but analysis showed that an important part of the gold was lost by using this method. A three-stage IHC jig system was installed, consisting of a 12-module jig as the primary stage. a 2-module jig as the secondary stage and a mini-module as the tertiary stage. Fig. 7 shows the installation of the primary jig.

Important factors in the choice of the IHC jig system were:

- The system had to have a higher recovery rate than the sluice boxes.
- The jig operation might not interfere with the sand and gravel process, and thus possibly delay the main product operation.
- The system had to be able to cope with surges of sand and gravel which exceeded the average design capacity.
- As the system had to be built within the existing plant, a minimum of construction space was demanded. The IHC jig system proved itself from the outset, giving very high gold recovery rates at high capacities and with a minimum of maintenance.

IHC jigs in hard-rock gold operation

Fig. 9 shows two 12-module IHC jigs installed as primary gravity separators in a hard-rock gold processing plant. The flowsheet of this operation is reproduced in Fig. 10.

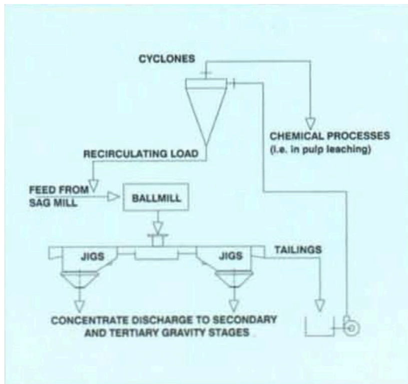
Using a gravity stop between the ballmills and the chemical recovery systems will result in recovery of the free gold at an earlier stage and more effectively in terms of cost.

Furthermore, the cyclone classifies, which means that it separates not only by particle size (for which it is installed), but also by specific gravity. Gold, with its very high specific gravity, will report earlier to the apex discharge of the cyclone than similar sized rock-matrix material.

This results in a higher percentage of gold than average material recir- culating in the ballmill circuit. and is known as overmilling of the gold. The installation of a gravity step will reduce this effect, as the gold will be recovered before it can be re- circulated by the cyclone. Moreover, gold particles with an oxidized coating will be concentrated by the gravity step, whereas certain chemical processes will have problems.

High slime contents, very small ballmill discharge and feed surges cause the jigs to operate near the limit and demand much more attention, compared with the other two examples described above.

However, operating under proper process conditions, the IHC jigs have proved able to maintain a high performance in terms of both recovery and ratio of concentration, while requiring only minimum maintenance.



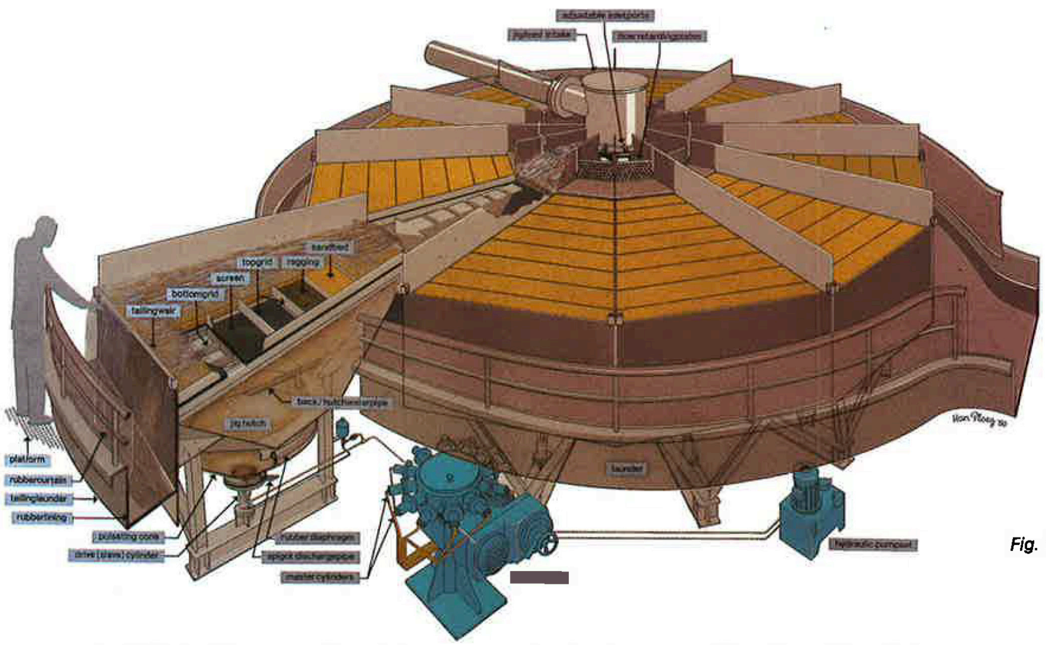


Fig. 1