KÜTTNER NEWS

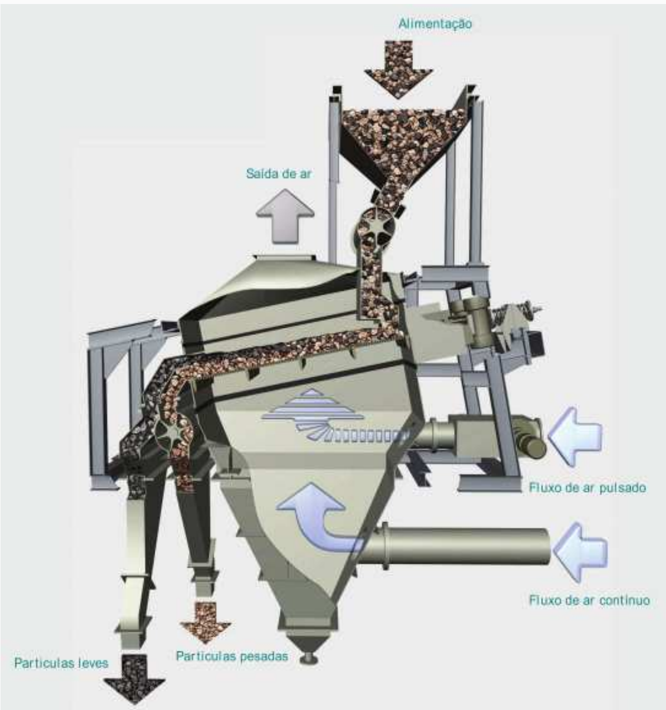
informativo trimestral | n.o 7 | ano II | ago/15

# SETEMBRO, MÊS DA FENAF E DA EXPOSIBRAM 2015

**EXPOSIBRAM 2015**
Expominas, MG
Dia 14 a 17 de Setembro
Estande T32

**FENAF 2015**
Expo Center Norte, SP
Dia 28 de Setembro a 1º de Outubro
Estande F26

**Venham nos visitar e conhecer nossas tecnologias.**
**Um especialista Kuttner estará ao seu dispor.**




# INNOVATIVE TECHNOLOGGIES FOR THE DENSITY SEPARATION OF LUMP IRON ORE

*Dipl.-Ing. Andreas Horn*
*Eng. Rodrigo Dias Ferreira*

Iron ore mining has been widely characterized in the past by methods developed for high grade deposits and relatively small mine outputs, i.e. selective mining of the high grade material and simultaneous dumping of low grades and fines.

This scenario has been changing dramatically in recent time for a number of reasons and demands new approaches:

- Ratio of high grade/low grade in the deposits is coming down
- The specific value of % Fe in saleable product increased over the last years by more than 100 %
- Fines, frequently disregarded as waste, are becoming a valuable product considering the upcoming sintering and pelletization capacities
- Modern beneficiation processes allow for effective and low cost upgrading of lump, fines and ultrafines

**Jigging technology | alljig®**

Separation of minerals in jigging machines is based on the fact that particles will stratify in pulsating water. The upward and downward currents fluidise and compact the grains into relatively homogenous layers. Low density pieces stratify on the surface, while specifically heavy grains settle to the lower level of the bed.

**alljig**® jigging machines are air-pulsed, because the pulsation of the water can be generated practically wear-free and so the stroke-motion (frequency, amplitude and shape) can be adjusted within a wide range, easily during operation.

After stratification the discharge of heavy product is done by an automatic, PLC- controlled discharge system. The discharge is the second criteria essential for excellent jig performance. In this regard a precise detection of the stratified density horizons and a continuous discharge of high grade product is needed, with a product discharge rate depending on feed characteristics, but guaranteeing a constant product quality independent of feed characteristics.

**alljig**® -jigs are in operation for the cleaning of different raw and recycling materials. The only prerequisite is a difference in the particle density.

More than 365 **alljigs**® have been delivered to date – worldwide. They are in use for various applications ranging from iron ore to coal, sand and gravel, as well as the recovery of metal from slag. Because of the low operating costs compared to heavy media plants and the possibility of higher separation densities (> 4,0 g/cm³) jigs are considered as state of the art equipment for iron ore beneficiation.

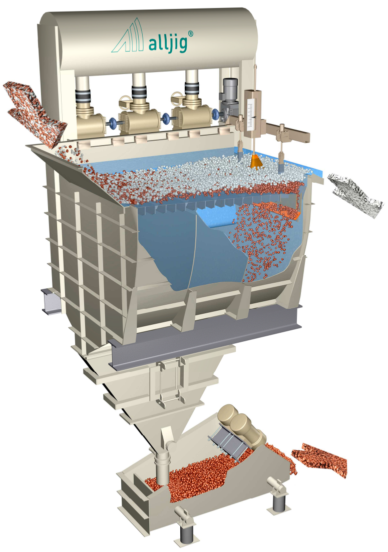



***Fig. 1:*** *alljig® for beneficiation*

Depending on the arrangement of the air chambers, side- and underbed-pulsed jigs are available. allmineral supplies both types, which are compared in Fig. 2. In terms of process efficiency, there is no difference between the two types of jigs since the same stratification is achieved with the same water movement.

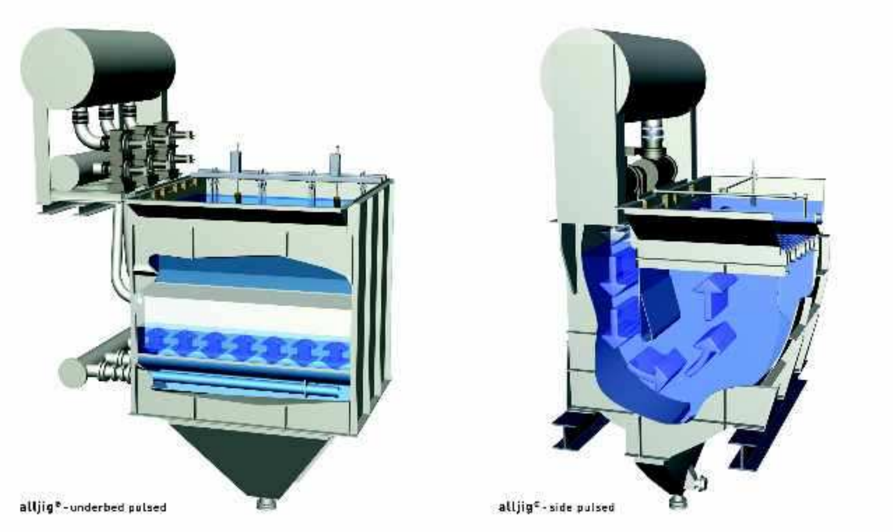



***Fig. 2***: *Comparison of underbed and side-pulsed alljig® machines-Schematic*

The side-pulsed Baum-type allmineral jig is limited to a jig bed width of 3 m. The largest underbed-pulsed jig supplied by allmineral is operated at a coal mine, it is 5 m wide.

The main differences concern the different position of the air chamber and type of air control. The disk valves used for the air control in the underbed-pulsed jigs need control air instead of the electrically driven rotary piston of the side-pulsed jigs. The maintenance costs for disk valves tend to be higher and even low wear leads to change in the control timing and therefore to a possible reduction in jig performance.

The control system of an underbed-pulsed jig is complex and requires a suitably qualified personel to operate it. In contrast, the Baum jig with side-pulsed action is simple to maintain and operate.

The jigs are widely used in iron ore beneficiation to reduce the amount of silica and alumina. While in South Africa, Australia and Brazil the silica content is in the focus, in India the challenge is more on the reduction of the alumina content. While the jigging technology has been in use for more than ten years in Australia, Brazil and South Africa, the Indian iron ore producers have discovered the value of this technology and are in the process of installing and commissioning.

**alljig® examples**

**alljig® for iron ore beneficiation**

Example 01

*South Australia | Iron ore separation*

Key Figures

1 x 100 t/h 8 - 1 mm
1 **alljig**® F 2500 x 3000

1 x 120 t/h 32 - 8 mm
1 **alljig**® G 2500 x 3000

start up August 2007

Dump material upgrading

***Fig. 3***: *Iron ore beneficiation plant Whyalla*

*Operation results from the lump ore jig at Whyalla*

| **LUMP FEED** | | | | | |
|---|---|---|---|---|---|
| Fe | 58,86 | 56,77 | 54,47 | 58,8 | 59,54 |
| $SiO_2$ | 6,22 | 8,11 | 6,62 | 6,35 | 5,52 |
| $Al_2O_3$ | 3,07 | 3,62 | 4,03 | 2,98 | 2,40 |

| **LUMP CONCENTRATE** | | | | | |
|---|---|---|---|---|---|
| Fe | 64,2 | 62,9 | 61,5 | 61,4 | 64,2 |
| $SiO_2$ | 3,62 | 4,33 | 4,8 | 3,47 | 2,42 |
| $Al_2O_3$ | 1,52 | 2,15 | 2,27 | 2,37 | 1,59 |

| **LUMP REJECT** | | | | | |
|---|---|---|---|---|---|
| Fe | 27,0 | 26,5 | 28,0 | 37,9 | 42,9 |
| $SiO_2$ | 26,82 | 33,6 | 27,68 | 21,65 | 15,8 |
| $Al_2O_3$ | 13,73 | 9,03 | 8,24 | 9,2 | 7,90 |

| | | | | | |
|---|---|---|---|---|---|
| **YIELD** | 85,6 | 83,2 | 79,0 | 88,9 | 78,1 |

**Example 02**

*South Africa / Iron ore separation*

***Fig. 4:*** *Iron ore jig plant, Sishen, South Africa*

Key Figures

4.000 t/h plant 25 – 0,8 mm

8 x 320 t/h 8 - 25 mm
8 **alljig**® G(UB) 4000 x 3000

8 x 165 t/h 3 - 8 mm
8 **alljig**® M(UB) 3500 x 3000

8 x 60 t/h0,8 - 3 mm
8 **alljig**® F(UB) 2200 x 3000

start up August 2007

*Operation results from the lump ore jigs*

| **LUMP FEED** | | |
|---|---|---|
| Fe | 61,11 | 56,83 |
| $SiO_2$ | 6,54 | 16,49 |
| $Al_2O_3$ | 3,15 | 1,42 |

| **LUMP CONCENTRATE** | | |
|---|---|---|
| Fe | 67,01 | 62,62 |
| $SiO_2$ | 2,18 | 8,15 |
| $Al_2O_3$ | 1,04 | 0,88 |

| **LUMP REJECT** | | |
|---|---|---|
| Fe | 56,44 | 52,62 |
| $SiO_2$ | 10,84 | 23,33 |
| $Al_2O_3$ | 3,85 | 1,67 |

| | | |
|---|---|---|
| **YIELD** | 44,2 | 42,19 |

**Example 03**

*Rajgangpur, India | Low grade lump ore processing*

*Fig. 5:* *Low grade lump ore jig at OCL jig plant, India*

Key Figures

4.000 t/h plant 25 – 0,8 mm

8 x 320 t/h 8 - 25 mm
8 **alljig**® G(UB) 4000 x 3000

8 x 165 t/h 3 - 8 mm
8 **alljig**® M(UB) 3500 x 3000

8 x 60 t/h0,8 - 3 mm
8 **alljig**® F(UB) 2200 x 3000

start up August 2007

**Operation results from lump ore jig at OCL**

| | | | | | |
|---|---|---|---|---|---|
| **LUMP FEED** | | | | | |
| Fe | 60,51 | 57,12 | 58,18 | 55,59 | 54,85 |
| **LUMP CONCENTRATE** | | | | | |
| Fe | 64,03 | 62 | 62,11 | 62,93 | 61,18 |
| **LUMP REJECT** | | | | | |
| Fe | 48,6 | 48,25 | 46,83 | 45,9 | 43,29 |
| **YIELD** | 77,2 | 64,5 | 74,3 | 56,9 | 64,6 |

**Pilot tests and characteristics of different iron ores**

Various samples of lumpy iron ores from Brazil and other countries have been tested regarding their beneficiation characteristics in allmineral **minjig**® pilot jigs. In the **minjig**® a sample is stratified and the different layers that are obtained are analysed separately. Fig. 6 shows the **minjig**® arrangement and fig. 7 shows the sampling.

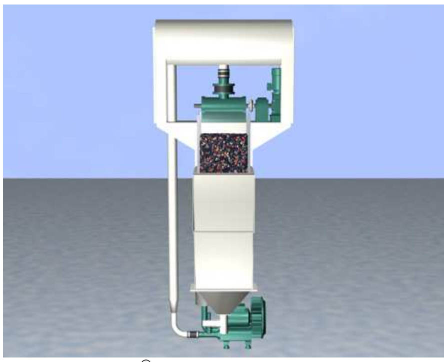


*Fig. 6:* *minijig*®

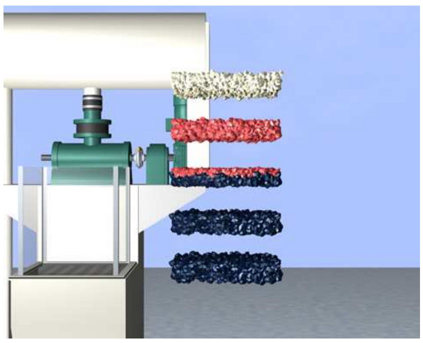


*Fig. 7:* *sampling after stratification in the minijig*®

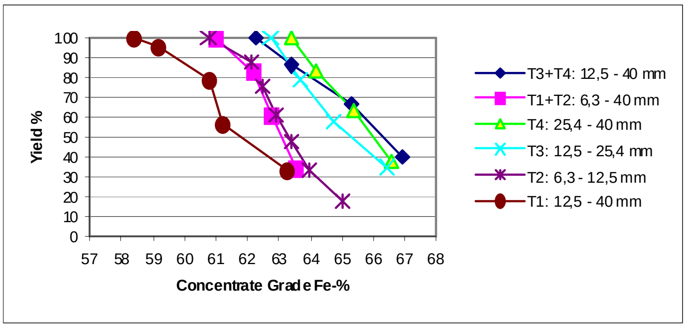



***Fig.8:*** *Stratification jig test results for different lump ores from Brazil*

In figure 8 the accumulated Fe% is drawn vs. mass %, i.e. at 100 m% the iron content in the feed of the respective sample is indicated, e.g. 61,3 % Fe for the sample T1+T2: 6,3 – 40 mm. From this diagram the yield to be expected at a certain product grade can be determined also. At 63,5 %Fe grade the yield for the sample T1+T2: 6,3 – 40 mm would be about 50 %.
Even with T1: 12,5 – 40 mm material 45 % yield can be expected at 62 % grade.

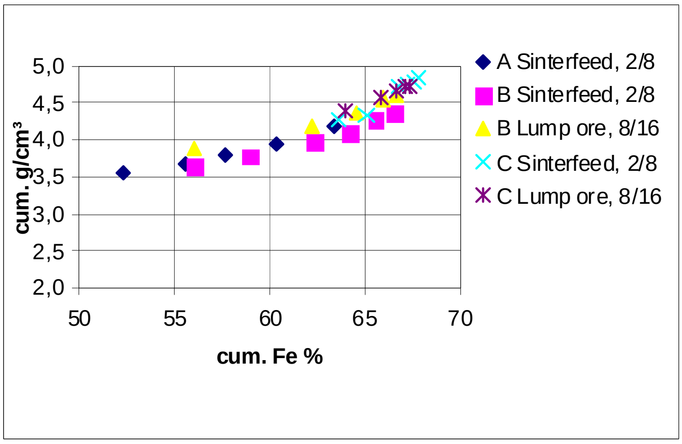



***Fig. 9:*** *Stratification jig test results for different iron ores*

From figure 9 the required cut points for a required grade can be determined. With the tested samples a cut point of > 4.0 g/cm³ is requested for product grades of > 60 % Fe, i.e. with Heavy Media processes such grades are not achievable.

**Conclusion**

The increased demand for iron ore concentrates in the last years as well as the mining of low grade deposits leads to a growing demand for separation technology for lump ores, sinterfeed and pelletfeed. Because of the low operating costs compared to heavy media plants and the possibility of higher separation densities (> 4,0 g/cm³) **alljigs**® are considered as state of the art equipment for the beneficiation of lump ore and sinter fines.