Magnetic and Electrical Separation, Vol. 3, pp. 129–136
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Equipment and Products

SUSPENDED ELECTROMAGNETIC SEPARATORS

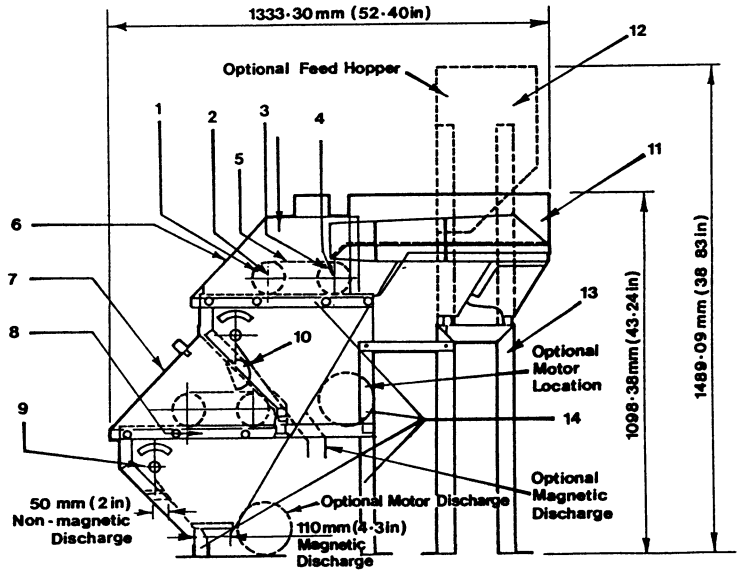
The SE series 7000 suspended electromagnetic separators developed by Eriez Magnetics are designed for removal of large amounts of tramp iron from loads on belt conveyors or in chutes. An external oil expansion tank helps prevent coil burnout by trapping moisture. There is no air space within the magnet housing for condensation to form and the design keeps the coils completely covered in cooling oil.

NEW PERMANENT ROLL MAGNETIC SEPARATOR

Although the roll magnetic separators that use rare-earth magnets have been applied to a wide spectrum of mineral processing applications a serious problem often encountered is the limited operating life of thin belts which these separators use.

One of several manufacturers of these separators, International Process Systems, Inc., U.S.A. claim to have solved this problem with their recently developed High-Force magnetic separator. The separator shown in the Figure is said to work well and allows a new roll assembly to give easier operational control and maintenance, coupled with lower manufacturing costs.

Requirements for effective dust control were considered in the design stage and have reportedly resulted in a trouble-free dust extraction system.



High-Force separator. 1-magnetic roll, 2-magnetic roll bearing, 3-idler, 4-idler roll bearing, 5- separator belt, 6- dust cover top, 7-dust cover, 9- splitter, 10-non-magnetic discharge chute, 11- vibratory feeder.

There are currently four basic models including a special unit for ultra-high purity quartz and one for processing a clean magnetic product. Three different belt tracking systems have been supplied.

SEPARATOR FOR NON-FERROUS METALS RECYCLING

Eriez Magnetics Europe, UK and Cotswold Research have jointly developed a separator for the recovery of non- ferrous metals, specifically for the metal recycling industry.

Following extensive testing of a prototype of the Eriez eddy current non-ferrous metal separator, using materials such as heavy media floats, non-ferrous waste and crushed dross, with a size range from 1 to 75 mm, an industrial scale mobile unit was constructed.

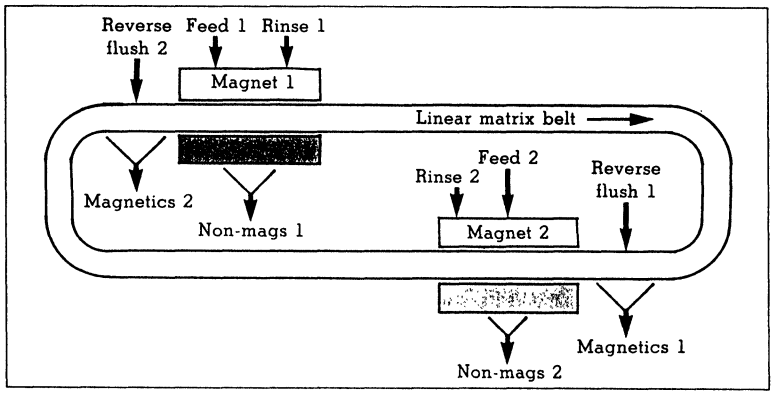
The unit, which is being used to upgrade the quality of non-ferrous scrap, operates by feeding material from a hopper via a vibratory feeder over a magnetic drum where ferrous particles,. including ferrosilicon, are removed. The material is then conveyed to the eddy current separator via a secondary vibratory feeder which causes non-ferrous metals to be propelled away from the non- metallic materials.

WHIMS FOR GOLD AND INDUSTRIAL MINERALS

During the past seven years the Minerals Engineering Division at Mintek, South Africa has carried out an intensive investigation into the development of linear wet high-intensity magnetic separation technology for the recovery of weakly magnetic minerals.

An article printed in Mintek Bulletin No. 33, January 1991 states that during the 1970s, tests using commercially available WHIMS equipment proved that it was possible to recover more than 50 per cent of the gold from Witwatersrand cyanidation residues and flotation-plant tailings into a magnetic concentrate varying between 8 and 16 per cent of the mass of the original feed.

The Solau WHIMS, patented by Corrans and Svoboda in 1984, incorporates two major design innovations that address the problems of scale-up and of matrix clogging. The vertical magnetic field is generated by means of a steel- clad split-coil solenoid which enables a wider matrix configuration to be operated in the most cost-effective manner. The matrix consists of woven steel-mesh screens forming an endless belt. This feature allows the magnetic fraction and the clogging material to be removed from the matrix by back-flushing, and enables the machine's capacity to be doubled by the incorporation of a second magnet without significantly increasing the physical size of the separator.



Schematic diagram of a twin-magnet linear high-intensity magnetic separator

Although the machine appeared to be a success in the initial stages of development (IEEE Trans. Mag. MAG-24, 1988, p. 749), it seems that, as a result of subsequent problems, it did not attract sufficient interest from industry. If such an interest can be generated, Mintek plans to build a scaled-up separator capable of treating 50 tonnes of feed per hour. A machine of this capacity, incorporating a longer magnetic tunnel and an improved roller-supported endless-belt matrix, would produce about 5 to 6 tonnes of concentrate per hour, sufficient for testing in a continuous pilot-scale carbon-in-leach plant to establish the optimum milling and leaching parameters for specific ores.

The recovery of undissolved refractory gold associated with weakly magnetic minerals in tailings would assist many marginal operations-an important consideration in times of low gold prices and rising mining costs.

The role of the WHIMS process for the preconcentration of gold ores should not be overlooked. A number of South African gold ores have yielded 80 per cent of the gold into magnetic concentrates with masses of 15 to 25 per cent of the feed.

One orebody yielded a 36 per cent magnetic concentrate containing 95 per cent of the original gold.

Although the separator has been designed primarily for the treatment of gold ore, the method would be suitable for the beneficiation of a wide variety of materials such as iron ores, beach sands and other industrial minerals.

PRODUCTION-SIZE HGMS IN OPERATION

According to an article published in SA Mining, Coal, Gold and Base Minerals, July 1991, two South African companies, Magnetic Technology Consultants (Pty) Ltd. and African Magnets (Pty) Ltd. have designed, developed and built a production-scale high-gradient magnetic separator that eliminates three fundamental shortcomings of previous designs. The magnetic field is generated by a simple steel-clad solenoid and is not limited by the saturation magnetization of steel used in iron-yoke magnets.

The unit can be easily scaled-up and the capacity of the separator is determined solely by the mechanical strength of the machine. The magnetic fraction is washed off from the matrix at the flush station in a direction opposite to that of the feed. This back-washing feature allows the matrix to be kept clean as particles to be removed do not have to be pushed through the entire depth of the matrix bed, a common feature of all other commercially available continuous HGMS machines.

The MTC-AFMAG separator can be custom-designed and built to suit any application, by selecting a suitable matrix and employing an optimum magnetic field strength. The unit built by MTC-AFMAG generates the magnetic field of 1.5 T in open space and uses woven steel mesh as a matrix. Versatility of the separator is demonstrated by the fact, that although the unit was designed primarily for wet applications, it is being currently tested in a dry mode on site by the world's major

producer of apatite. The powerful vacuum system is used to propel the ore through the matrix. An ingenious design of vacuum seals allows the high velocity of an ore, and thus a high throughput, to be achieved. It is claimed that the separator was designed and built in a record time and, in contrast to most projects of similar nature, very few snags were experienced during the commissioning.

The separator is suitable not only for dry beneficiation of industrial minerals but is suited for the recovery of gold and platinum-group metals from the tailings. It is also applicable for the beneficiation of a wide spectrum of materials such as beach sands, iron ore, glass sand and others.

HAND-HELD MAGNETS FOR METAL SORTING

A new line of hand-held electromagnets is claimed to speed the sorting of ferrous metals in small-volume operations. The new units, recently introduced by O.S. Walker, a scrap-handling equipment maker, come in the form of a 0.7 kg "Micro-Mag", 70 mm in diameter, and a 2.7 kg "Mini-Mag" which is 127 mm in diameter. Each magnet features what the manufacturer called a "high- intensity, deep-penetrating field" to allow for faster and more efficient sorting. The units also have a built- in solid-state rectifier that enables to use the ac mains. A power switch is mounted next to the handle.

IN-HOLE FISHING MAGNET

In-hole fishing magnets are used to remove broken drill tools from exploration boreholes. Recently Core Drill (UK) Ltd. supplied such a unit to Silverdale Colliery in UK. The unit was attached to the drill rod and lowered to 200 m where the roller cones and loose bearings attached to the magnet and were able to be

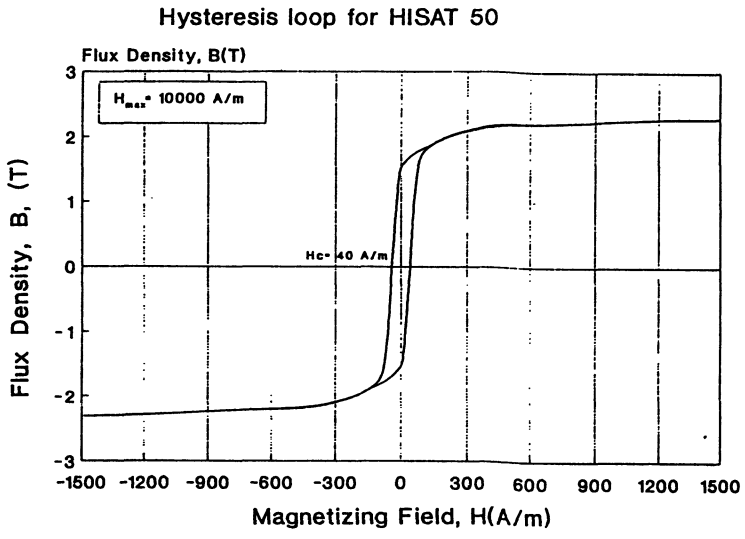
withdrawn. The unit incorporates a 25 mm thick rare-earth magnet and is designed to fit inside a standard corebit. The sizes available are 76 mm (lifting capacity 75 kg), 116 mm (lifting capacity 120 kg) and 146 mm (lifting capacity 145 kg).

A NEW HIGH SATURATION SOFT MAGNETIC CO-FE ALLOY

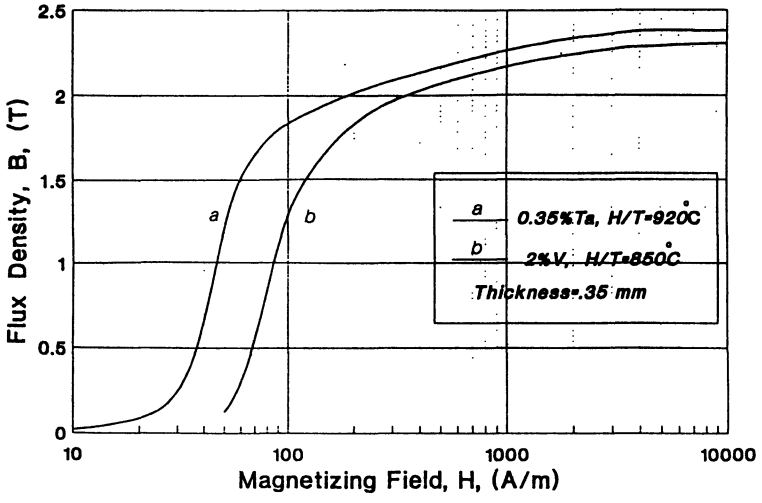
Cobalt-iron alloys in the composition range 24-50 per cent Co form an important class of soft magnetic material. They have the highest known room temperature saturation magnetization and are employed primarily as a flux-carrying material in applications where minimum mass or volume is essential. Pole tips in high-performance magnets is a typical application.

The binary Co-Fe alloys are not generally used commercially since ternary additions, such as V or Cr, are required to enhance their ductility sufficiently to enable them to be cold-worked. A 2 per cent addition of vanadium provides such ductility and the 49Co/49Fe/2V alloy, Permendur, has excellent all round performance in terms of saturation magnetization and permeability. The vanadium addition does, however, reduce the saturation magnetization by approximately 0.1 T compared with the binary alloy.

Alternative addition elements have been discovered which have the benefit of not materially degrading the saturation magnetization. Telcon Metals Ltd. have developed an alloy HISAT 50 based on one of these novel additions, tantalum, to provide the higher saturation of 2.44 T, together with a higher permeability (μmax 20 000) and a much lower coercive force (15 A/m), compared with existing alloys.



The addition of 2 per cent of vanadium, however, produces an increase in resistivity, which is valuable as regards minimising the eddy current losses. Whilst the new HISAT 50 alloy has a lower resistivity, the impact this has on the total losses is partially offset by a lower hysteresis loss.



(By courtesy of Cobalt News, August 1991, p. 10)