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Twin Primary Jaw Crushers – A cost efficient mining industry new technology alternative to conventional gyratory primary crushing stations for high volume processing of ore or hard rock.

Gyratory crushers have been the traditional, high capacity choice for primary crushing stations. Can today's massive, new jaw crushers offer a viable alternative?

Traditionally, large mining operations have relied on gyratory crushers for use as their primary crushing stations. Gyratory crushers effectively reduce coarse feed material to the optimal size for downstream secondary and tertiary crushing stages of a mineral processing or large quarry operation. Materials such as iron ore, copper ore and limestone, produce a wide range of fragmentations when drilled and blasted. Until recently, high capacity gyratory crushers were the only suitable primary machines to handle feed tonnages above 1000 tph. Generally, gyratory crushers can crush ore with a top feed size of 54 inches at rates up to 5000 tph. Furthermore, gyratory crushers are capable of producing a product size of roughly 8 inches and can have an installed power consumption as high as 750 kW. In large open pit mines, truck loads of slabby material can be discharged directly into a gyratory's spider-reinforced opening, fed from any side without screening out fines and can be choke-fed while still maintaining their capability of continuous output. But to be certain, gyratory crushers require substantial capital investment and introduce a large installation footprint and height requirement. In underground mining installations, where real estate is at a premium, employing these massive, bulky and tall crushers, presents a different set of installation and operation issues, including extensive site preparation, infrastructure and process engineering.

The high cost of gyratory primary crushing.

A gyratory's high productivity and reduction ratio, as it applies to coarse crushing of various ores and rock, comes with a high capital investment and associated operating costs. While the gyratory crusher is effective, it is also accompanied with a number of disadvantages. Initial capital investment is very high and the machine, foundation

and supporting structure's design, manufacture and installation is correspondingly very ambitious. The entire procurement and installation-to-operation process can take up to two years or more. Considerable project costs include delivery of the unit as well as installation costs. The gyratory machine requires design and installation of a complex structure consisting of a tall cone within a shell, a main shaft and mantle, as well as a countershaft all engineered to provide an eccentric, continuous crushing action. This complex structure results in a crusher design of substantial height and inherently difficult to access and maintain, thus making repair or replacement of sophisticated components difficult and costly.

Should a complex, costly, sophisticated crusher design be the only option for primary coarse crushing?

Consider that the top bearing in a gyratory is naturally subjected to extreme and unbalanced loads. Should failure occur with one of these high maintenance components, production stops entirely. Over the years, gyratory manufacturers have worked to address several design issues, such as threads on the mainshaft being prone to fatigue failures, prevention of damage caused to other parts such as the headnut and mainshaft by oversized, abrasive feed material, or problems with excessive or hard to crush material blocking the crushing cavity, causing slipping or jumping of the mainshaft and possible motor overload. In some gyratory crusher models, hydraulic adjustment of the mainshaft helps to compensate for wear, but does not allow control of throughput and size distribution. While more recent control system advancements offer these features, they can be complicated requiring highly-skilled employees.

There are also serviceability issues to consider. Concave gyratory liners can become deformed in some models, as material continually hammers on the manganese steel. This requires service personnel to climb inside the crushing chamber to trim the stretched concaves with a blow torch, a potentially dangerous safety issue as loose concaves can detach while servicing.

In summation, for all the high productivity gyratory machines bring to large mine and quarry operations, there exist legitimate reasons to explore, based on application, other alternatives for a primary crushing station

Today's higher capacity jaw crushers often offer a better alternative.

Today, very large model, high capacity, heavy duty jaw crushers are being considered, selected and installed in lieu of the gyratory option. These jaw crushers are in fact the optimal choice for certain primary crushing parameters. Jaw crushers are far less complex machines, have lower height requirements and simpler supporting structure and foundation requirements. They offer reliable, repeatable performance and are very easy to maintain. The jaw crusher's open side or "throat" is comprised of two opposing non-parallel plate assemblies. One plate is held stationary while the second, opposing plate, moves as an integral part of the swing jaw assembly whose movement is defined by an eccentric shaft. This elliptical plate action applies the crushing force to the devoured rock by trapping it in a tapered configuration, where fractured rock is progressively broken into smaller pieces until it falls through the closed side or "gap" at the bottom of the opposed jaw plates. The plate assemblies are often lined with reversible and easily replaceable high alloy liners to reduce wear. A hinged jaw's

crushing action is considered to be cyclic and progressive, rather than continuous.

Gyratory crushers, fundamentally, also provide the same progressive crushing action as a jaw, however a gyratory's eccentrically driven mainshaft and cone-type design configuration makes it capable of continuous output. Therefore, a gyratory has been traditionally considered to be the generally preferred, albeit costly, choice for large, very high capacity, high throughput, continuous and coarse crushing mining applications. Of course, different mining applications present unique sets of problems and specific application consideration may point to a jaw preference instead. For example, mineral processing operations, mining an open pit nickel deposit, seeking to increase primary crushing capacity, may find the crusher wear mantle supplied in their gyratory is the wrong profile for processing slippery black schist. This could generate a crushing condition causing material to jump up the cavity, resulting in significantly lower crushing capacity than originally expected. The need for a foundry to cast costly custom mantles made of a special manganese type may be required to correct the problem.

While there are sometimes issues with any type of crushing machinery, depending on the specific mining or aggregate application, there are numerous instances where the right jaw can provide greater flexibility and is a much more attractive option.

Changing conventional rules.

Today, Lippmann, a leading jaw crusher manufacturer located in the US, has introduced a new, massively constructed 5062 model heavy-duty jaw crusher. The high capacity Lippmann primary crushing station employs two 5062 jaws running in a side by side or "parallel" configuration. This parallel installation of Lippmann 5062 jaw crushers has challenged the limits of high productivity and high throughput previously thought possible from any prior-designed primary jaw crushing station. Because the robust twin jaws can be installed for the cost of one single gyratory installation, Lippmann offers material processing operations a serious, previously unavailable alternative with high capacity, high throughput, highly productive and cost efficient crushing alternative. Of significant consideration is that the Lippmann concept assures a mining or aggregate processing operation 100% uptime with and due to redundancy. When considering proper equipment selection, twin jaws may not be the right solution for every application, but this option may change the equation for many.

Once capacity and throughput are achieved, simplicity, lower initial capital investment, lower installation costs, and ease of operation and maintenance trump convention.

Lippmann engineered the 5062 Jaw to crush extremely hard, abrasive material in demanding environments. This required a huge oversized heat treated shaft, larger roller bearings, a huge pitman, a larger stroke with a steeper angle, and a much heavier frame than conventional jaws. The result of this design effort demonstrates that extra strength can be built into a jaw crusher at a much lower initial and lifecycle cost than a gyratory. A standard Lippmann 5062 Jaw was designed, therefore, to be more rugged, durable and cost effective than a standard gyratory at the outset and throughout the life of a project. The Lippmann 5062 design also offers an advantage over the gyratory in that extra coarse material hang-ups inherent at the top of a spider gyratory are non-existent with the jaw's large, unobstructed feed opening, which accepts massive, irregular blocks. A jaw also handles sticky or dirty feed better than a gyratory,

because there is no partition below the crushing chamber where material can pack up. Furthermore, due to the jaw's simplicity of design and parts accessibility, routine maintenance and servicing are more easily accomplished when contrasted with similar tasks associated with a complex gyratory. Coupled with these advantages, the 5062 jaw, utilizing a hydraulic toggle, is also easily adjusted to compensate for liner wear with generally greater adjustment range in contrast to the gyratory. These hydraulic toggle cylinders not only save countless operating and maintenance hours but can actually be adjusted while the jaw is operating and under load.

Shortened lead time to take delivery.

The twin 5062 crushers can be manufactured in a fraction of the time it takes to manufacture a gyratory, thus jaws are more promptly delivered and installed. The more advantageous installation of the 5062 includes less costly civil engineering, a reduced installation requirement set and improved ease of operational support. Training and operation are also simplified. Working together, the twin units can achieve gyratory-comparable material throughput and provide a better ratio of reduction, while virtually eliminating any risk of total production stoppage from the primary station. For many operations today, installation and operation of the twin jaw alternative presents a reasonable, highly cost efficient and highly reliable option to the conventional primary gyratory crushing station.

Early adopter.

Savage Stone Incorporated (SSI), owned and operated by Laurel Sand & Gravel, a state-of-the-art crushing installation located in Jessup, Maryland, decided the Lippmann 5062 primary jaw solution was the right alternative to installing a primary gyratory for their hard rock, high volume crushing installation. Approximately fifteen different layout and flow options were considered resulting with a final selection of the Lippmann 5062 primary jaw. This primary jaw plant began start-up in October 2005.

The quarry's deposit of Baltimore Gabbro rock has a specific gravity of 2.98 gm/cc, a compressive strength of +50,000 psi, and a silica content of approximately 55%. Originally, Savage Stone thought that no jaw crusher could hold up as the primary heart of their operation under those hard rock conditions and the company assumed a primary gyratory would be required. In spite of this conventional thought, the option of a jaw crusher remained in consideration based on lower cost, ease of maintenance and the fact that two machines could be installed for the cost of one gyratory installation, says Craig Gartzke of SSI. Lippmann guaranteed that their jaw solution would do the job, stated Owen Stewart, V.P. of Operations at Savage Stone. "Lippmann came along and said they've crushed harder rock than this all day long and they were right. We're totally satisfied. Despite the hardness and abrasiveness of this rock, even the wear items have exceeded all of our expectations."

Phil Gosnell, Site Supervisor added "I came on board three months ago coming from operations that were using primary gyratory crushers. I wouldn't have thought a jaw would do it, but the Lippmann 5062 jaw is doing an awesome job". Gosnell points out the air springs maintain a pre-set loading on the tension rods, regardless of setting. The air springs ensure sufficient force is maintained to securely hold the hydraulic toggle cylinders in position, which means that an operator can adjust the jaw setting while under load. The installation is designed to produce 1500 tph through the Lippmann primary jaw, and 1200 tph through the tertiary plant. "The concrete is poured and

the electric conduit is installed for the second 5062 jaw, but right now, the first one is doing such a good job, the second one is not required yet", states the company's vice president of operations.

Blasted rock is loaded by two 17 cubic yard Komatsu loaders and hauled up to the primary hopper by four 100 ton Euclid trucks. Material is then fed over a 62" x 28" vibrating grizzly feeder (VGF). Any oversized feed in the VGF is broken-up by a hydraulically-controlled pedestal boom with breaker. The pass thru goes to a three deck 8' x 20' Diester screen which allows Class I, gabion, #2, or CR6 to be pulled, if desired, with stackers. Hydraulic gates allow none, some or all of any deck to be pulled or returned to the secondary crushers or to the tertiary surge. The jaw is usually set at 6 and ¾" css and both S6800 secondary crushers are set at 2" css. Everything from the secondary crushers goes to the live 6,000 ton tertiary surge. The Lippmann plant allows the company to pull any material out that they don't want to send over to the tertiary plant. Within the tertiary surge tunnel are five feeders. One can be used to return material to the Lippmann 5062.

Steve Prentice who oversees the plants and plant maintenance states "The 5062 is an easy nuts and bolts machine to work on regardless of how heavy it is. I look forward to seeing the other one sitting next to it." In 2007, using the single Jaw, Savage Stone's scale house was on track to ticket approximately 1.9 million tons of stone products.

Proper equipment selection.

Each mining and aggregate operation has unique considerations that factor into proper equipment selection. Matching a plant's specific throughput requirements, maximum feed size requirements, crushability and strength of feed material, distribution, and discharge settings for optimum utilization of downstream crushers, as well as other considerations must be carefully factored to achieve maximum crushing efficiency and minimum cost per ton of material processed. The Lippmann twin 5062 Jaw Primary Crushing Station is a suitable option worth consideration that has proven to exceed expectations for an increasing number of leading, large mining and aggregate installations.

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