

Introduction of Product

BR1000JG-1 Mobile Crusher

Takumi Onoda

KOMATSU has proposed “on-site recycling method” to crush and reuse concrete debris generated when a building is demolished and natural stones dug out during civil engineering work with mobile crusher, and marketed GARA-PAGOS series for this purpose. For 48-inch class, which is the main market in the quarry industry where jaw crusher has traditionally been used, KOMATSU designed a peculiar 50-inch crusher. This crusher not only realizes a large treatment capacity but also remarkably improves operability and maintainability by employing lock cylinder mechanism to facilitate the adjustment of discharge clearance and eliminate the down time due to clogging of foreign material. This crusher is installed in newly developed BR1000JG-1 Mobile Crusher, which has recently made its appearance on the market.

Key Words: GARA-PAGOS, Mobile Crusher, Jaw Crusher, Hydraulically Adjustable Jaw, Quarry

1. Introduction

Various debris from construction work some dozen years ago

- Concrete debris from demolished buildings, etc.
- Asphalt debris from road repairing work
- Natural rocks from civil engineering work

The debris was transported to disposal sites. Environmental and economic problems occurred due to rising disposal costs from a shortage of disposal sites and transportation of debris and new aggregates by dump trucks. Under such social circumstances, in 1992 Komatsu introduced mobile crusher BR60 equipped with an impact crusher for the purpose of “on-site treatment of miscellaneous debris from the demolition of wooden houses .” In 1993, Komatsu developed BR200J-1 with increased capacity and equipped with a jaw crusher capable of disposing of large masses in large-scale demotion and civil engineering work to promote on-site recycling method. Later the workability was improved by applying a three-way loading structure and a conveyor with increased discharge height. A vibratory feeder to remove muck, and automatic feeding control was installed to increase production. In August last year, Komatsu began the sale of BR380JG-1 equipped with a crusher of improved maintainability and operability through its own development. This machine continues to sell steadily.

On the other hand, separate from the field of disposal by crushing of debris from construction work , the following method has been conventionally adopted in the quarry field where the jaw crusher was originally used:

- After blasting, blasted rocks are collected by a bulldozer.
- Rocks are loaded on a dump truck by a hydraulic excavator or wheel loader and transported to a crushing plant.

At some sites where the benches height is large, an open chute method is adopted to drop blasted rocks with the bulldozer. As exploitation proceeds, however, distance between the working face and the aggregate production plant becomes greater causing the hiking of blasted rock transportation costs to the plant. To cope with the circumstances, a new method has been adapted by which a mobile crusher is arranged near the working face as the primary crushing equipment, and the primarily crushed rocks are transported by either a conveyor or a 10-ton dump truck to the secondary crushing plant and onward. At Komatsu we can carry out primary crushing at the working face, then transport the primarily crushed rocks over the conveyor with a combination of a mobile crusher BR1600JG and mobile conveyor BM2014C. Moreover, Komatsu proposed the following systems using mobile crushers in the quarry field:

① New quarry development system

Enables efficient development of a new quarry by a combination of a mobile crusher and a loader, requiring no electric power supply or foundation work for fixed type crushing plant. Thus, primary crushing can be done in a narrow space, and crushing site can be moved according to the quarry site formation after stripping.

② Working face on-site production system

Enables production of aggregate in the working face and product delivery directly from there. Mobile crushers perform primary and secondary crushing and crushed rocks are sorted with mobile screens within the working face. These mobile machines allow flexible movement from one working face to another. In addition, aggregate products can be transported in a 10-ton dump truck which requires minimum road construction, contributing to environmental load reduction.

Under those proposals, Komatsu has developed and marketed the large-type mobile crushers, BR500JG-1, BR550JG-1, and BR1600JG-1.

We have also developed and begun marketing BR1000JG-1 equipped with a jaw crusher of the 48-inch class which is predominant in the quarry field. The general profile of this new machine is as follows:

2. Aim of development

BR1000JG-1 aims at

- meeting diversified needs for mining equipment, and
- mobility to follow working face location changes.

It is a product with that has unprecedented functions with the original 50-inch jaw crusher newly designed and manufactured by Komatsu.

Table 1 indicates the development aim of BR1000JG-1 and achievement methods. The following section will describe detailed achievement methods.

In addition, **Photo 1** shows an overall appearance picture of BR1000JG; **Table 2** the main specifications, and **Fig. 1** a general view.



Photo 1 Overall appearance of BR1000JG

Table 2 Main specifications

Item		Unit	BR1000JG
Performance	Maximum treatment capacity *1	t/h	800
	Maximum feed-in size *2	mm	1,200x1,000x750
	Travel speed	km/h	1.7
	Gradeability	Degree	20
Engine	Model	-	SAA6D140E
	Flywheel horsepower	kW (PS)	338(460)/1,800
Operating weight		kg	93,000
Dimensions	Overall length	mm	16,400
	Hopper feed-in height (rear/side)	mm	5,300/5,640
	Overall width	mm	4,465
	Conveyor discharge height	mm	3,000
	Length of track on ground	mm	4,250
	Minimum ground clearance	mm	450
Crusher	Model	-	Single toggle
	Inlet size	mm	1,260x1,000
	Discharge clearance (opening side)	mm	125 - 280
Hopper	Capacity (upper surface of the pan)	m ³	8.2
	Length x width	mm	5,500x3,650
Feeder	Model	-	Two-stage grizzly bars
Conveyor	Belt width	mm	1,200

*1: Treatment capacity is the sum of the quantity of the material crushed by the crusher and the quantity of the material that passed through the grizzly bar. It depends on the type and properties of the materials and the working condition.

*2: The maximum feed-in size means the maximum size of the materials that can be crushed when it is supplied in a proper direction.

Table 1 Development aim and the achievement methods

Development aim	Achievement methods	
Meeting diversified needs for mining equipment	Large throughput	50-inch jaw crusher, the largest for 48-inch class Large hopper and large capacity conveyor
	Easy operation	Automatic adjustment function for crusher discharge clearance Employment of toggle plate protective device for clogging with foreign material One-man operation Fully hydraulic-driven system including the crusher
	Reduction of operating cost	Optimized swing jaw plate locus and improved wear life through the adoption of up-thrust mechanism
Meeting the changes of the working face location	Mobility	Superb travel performance with the remote travel control
	Ease of disassembly transportation	5-unit tear down structure (3.2 m wide x 3.2 m high with mass of under 32 tons)
Others	Reliability and durability	Use of components common to Komatsu construction equipment Adoption of construction equipment-based hydraulic and electronic control system Installation of protective guard to the rear of the conveyor
	Maintainability and safety	Centralized arrangement of operating switches and monitor to enable operation from the ground

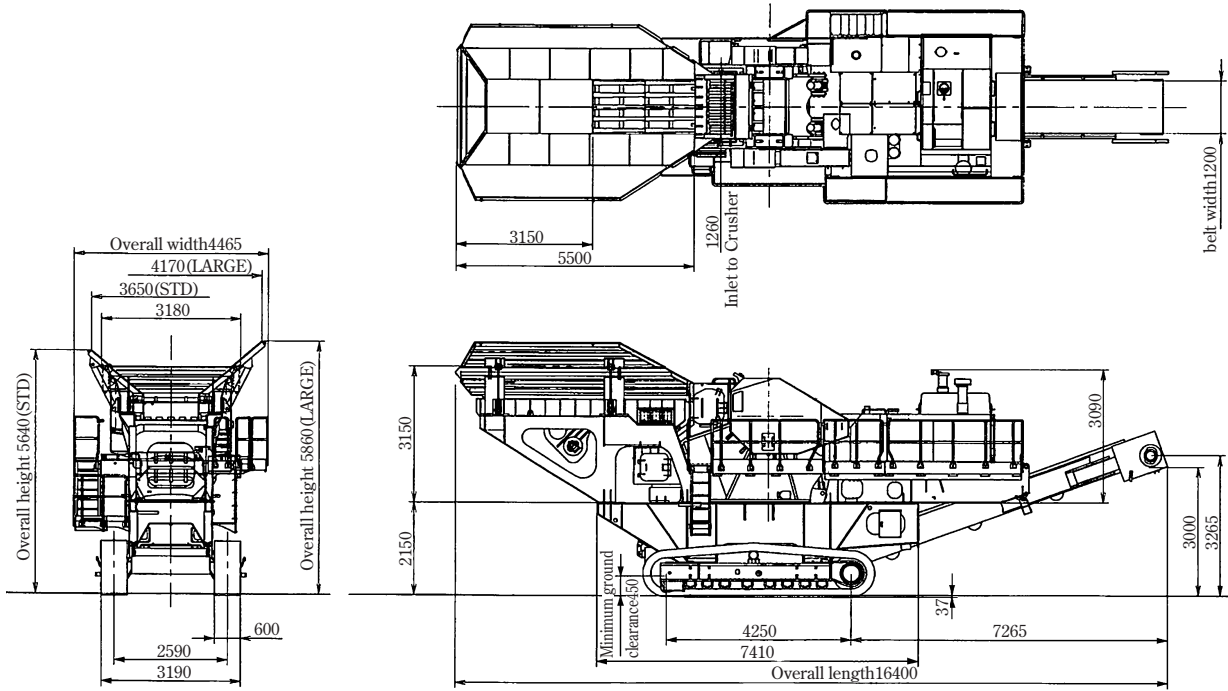


Fig. 1 General view

3. Introduction of achievement methods

3-1 Large throughput

- (1) The largest jaw crusher in this class
A 50-inch hydraulic driven jaw crusher provides a large production capacity, largest in this class (inlet size of 1,260 x 1,000 mm)
- (2) Large hopper and wide crusher discharge port
Equipped with a large folding type hopper having a capacity of 8.2 m³, it enables loading using a hydraulic excavator of the 3 to 4 m³ bucket capacity class. (Photo. 2)



Photo 2 Hopper

3-2 Easy operation

- (1) Hydraulic lock cylinder is installed on the crusher
Adoption of a special-structured lock cylinder has added the following functions:
 - Automatic discharge clearance adjustment function
Clearance adjusted by extending the cylinder (reducing clearance) or retracting (increasing clearance)
 - Toggle plate protection function when the crusher is clogged with foreign material
When clogged with foreign material, the cylinder piston forcibly slides to open the discharge clearance to release the load.

Regarding automatic adjustment of discharge clearance, a conventional crusher is constructed as shown in Fig. 2. To adjust the discharge clearance, it is necessary to carry on a series of work as follows using heavy shims and large tools:

- ① Loosen the toggle block tension bolt.
- ② Extend the hydraulic ram with a manual pump.
- ③ Remove shims (when expanding clearance) or insert them (when reducing clearance).
- ④ Retract the hydraulic ram with a manual pump.
- ⑤ Tighten the toggle block tension bolt.
- ⑥ Check that the desired clearance is obtained using a discharge clearance measuring jig.

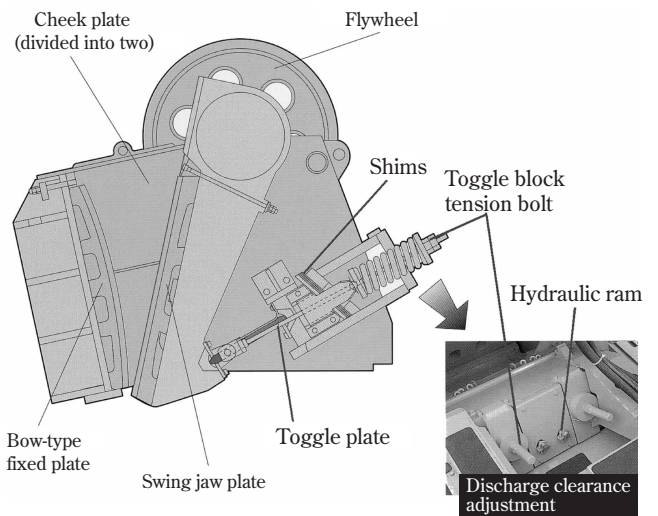


Fig. 2 Crusher construction of conventional machine

BR1000JG-1 can reduce or increase clearance by controlling the lock cylinder in the crusher structure shown in Fig. 3. This can be effected by operating the monitor switch in the control panel operable from the ground. Since the discharge clearance detected by the sensor is displayed on the monitor, no discharge clearance adjustment jig is needed to check the clearance. This enables the operator to adjust the discharge clearance from the ground without riding on the machine.

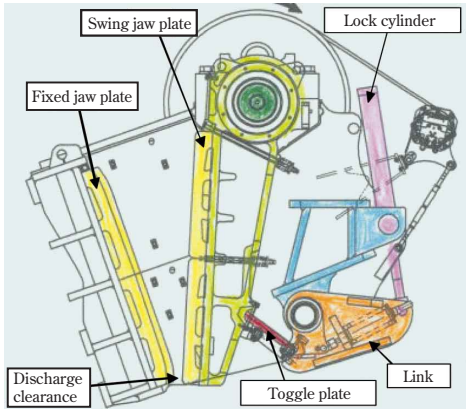


Fig. 3 Structure of BR1000JG-1

The multi-function monitor on the control panel is used for adjusting discharge clearance. Clearance can be set in the following three modes:

In Mode A, discharge clearance can be adjusted by entering the desired clearance between 125 and 280 mm using the clearance setting input switch. In Mode A, first the clearance reduces until the swing jaw plate makes contact with the fixed jaw plate. This point is recognized as actual clearance zero (0) in order to compensate the worn portion of the jaw plates. Then the clearance begins to expand until the entered clearance is reached, thus completing the adjustment.

In Mode S, clearance is adjusted by entering increasing/decreasing amount from the current discharge clearance using the clearance setting input switch.

In Mode M, clearance can be reduced or expanded by operating the manual setting adjustment switch. Use this mode when removing clogged foreign material by opening the clearance to the maximum.

Fig. 4 shows the clearance adjustment screen of the control panel and the switch section.

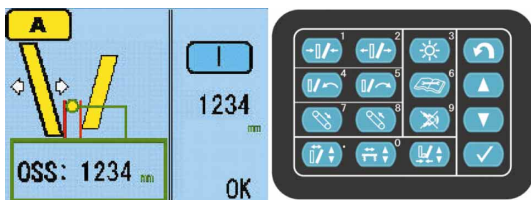
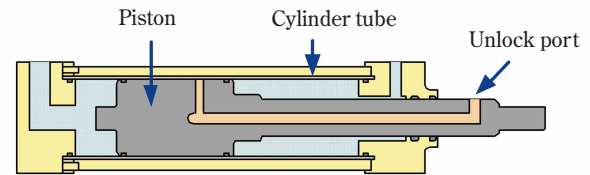


Fig. 4 Control panel (for clearance adjustment)

Toggle plate protection function when the crusher is clogged with foreign material. When the crusher is clogged with foreign material and loaded with an excessive load exceeding the lock cylinder retention force, the clearance

sensor detects that this lock cylinder has retracted with a forced sliding of the cylinder piston and work equipment completely stops to protect the toggle plate. The lock cylinder is locked with the cylinder tube and the piston in the state of shrink fit. By structure, if an external force exceeding the locking force is applied to the cylinder, the locking force yields to the external force and the cylinder retracts. To have the lock cylinder extend or retract like a normal cylinder, apply hydraulic pressure to the unlock port. Then the cylinder tube bulges and unlocks the piston to enable the cylinder to extend or retract.

Fig. 5 shows a structural diagram of the lock cylinder and Table 3 indicates the state of the lock cylinder (piston). When locked



When adjusting

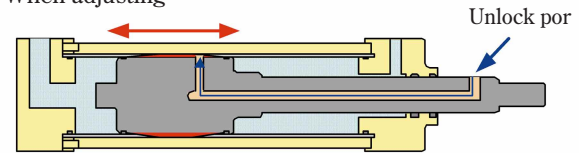


Fig. 5 Structure of lock cylinder

Table 3 The state of the lock cylinder (piston)

During work		During clearance adjustment
Normal load	Clogging of foreign material	
Lock	Forced sliding	Hydraulic unlocking

(2) One-man operation

A single loader operator can operate a BR1000JG with the following features:

- Automatic feeder control in response to an excessive crusher load
- Feeder speed setting in response to working conditions
- Stopping and controlling of work equipment with an optional radio controller (Photo 3)



Photo 3 Radio controller (optional)

(3) Fully hydraulic driving of work equipment

The hydraulic-driven crusher increases the crushing torque and enables restarting after clogging stop. This reduces machine downtime.

- Releasing the crusher from blocking by removing large rocks from crusher inlet
- Restarting equipment when the crushing chamber is clogged with rocks

3.3 Reduction of operating cost

As a single toggle crusher specially designed for crushing blasted rocks, this machine aims at developing a double toggle locus of the swing jaw plate by adopting up-thrust linkage to extend the wear life of fixed jaw plates.

Table 4 outlines the up-thrust linkage and down-thrust linkage adopted for the series machines of Komatsu.

<Swing jaw plate locus of up-thrust linkage>

Because of the fixed jaw plate relative angle θ_1 > swing jaw plate angle θ_2 , rock is less likely to slide on the fixed jaw plate and the fixed jaw plate is less prone to wear than the swing jaw plate.

Table 4 Relationship between crusher linkage and plate wear

Item	BR1000JG (Up-thrust linkage)	Komatsu series machines (down-thrust linkage)
Construction		
Relationship between the swing jaw plate locus and relative angle	$\theta_1 > \theta_2$	$\theta_1 < \theta_2$
Early wearing plate	Swing jaw plate	Fixed jaw plate

3.4 Mobility

Able to remote-control travel by large traction force while checking the surrounding conditions from the ground (**Photo 4**)



Photo 4 State of traveling

3.5 Ease of disassembly transportation

A 5-unit tear down structure is optimal for transportation and facilitates re-assembly in job site (3.2 m wide x 3.2 m high x mass of under 32 tons). (**Photo 5**)



Photo 5 Disassembled unit for transportation (crusher)

3.6 Reliability and durability

- (1) Use of components common to komatsu construction equipment

Components common to Komatsu construction equipment are used for the engine, pump, motor, controller, and other main components.

- (2) Protection of the conveyor rear section

The following structures prevent the conveyor from being damaged by large debris falling during loading: (**Photo 6**)

- Side: The tail length of the conveyor has been reduced and arranged within track width.
- Rear: A conveyor protection guard has been installed.



Photo 6 Conveyor tail section

3.7 Maintainability and safety

- (1) Centralized control panel for operation and monitoring

A centralized control panel enables operation and monitoring from the ground. This enables the loader operator to operate the crusher with ease. If any trouble occurs, the monitor displays the error content and specifies abnormal sections to reduce maintenance hours and machine downtime.

- (2) Wide deck and steps

A wide deck and steps are provided around the power unit and crusher to retain maintenance space. (**Photo 7**)



Photo 7 Deck and steps

4. Cases of actual operation

Two users to whom we delivered the machine put it to different uses respectively. The first user uses the machine for producing rubbles.

- (1) They use the machine with the discharge clearance open to the maximum.
- (2) They use a large wave ridge jaw plate with smaller number of waves for coarse crushing.

Another user uses the machine as the primary crusher to feed material to a secondary plant.

Fig. 6 shows the relationship between the existing plant facilities and BR1000JG-1. By feeding a part of the existing secondary crushing plant with rocks primarily crushed by BR1000JG at the working face, this user is able to process different types of rocks simultaneously at the secondary crushing plant to produce different types of aggregates for shipment. In addition, this user can now have BR1000JG travel to other working faces for crushing rocks and produce aggregates on the spot to meet market needs promptly.

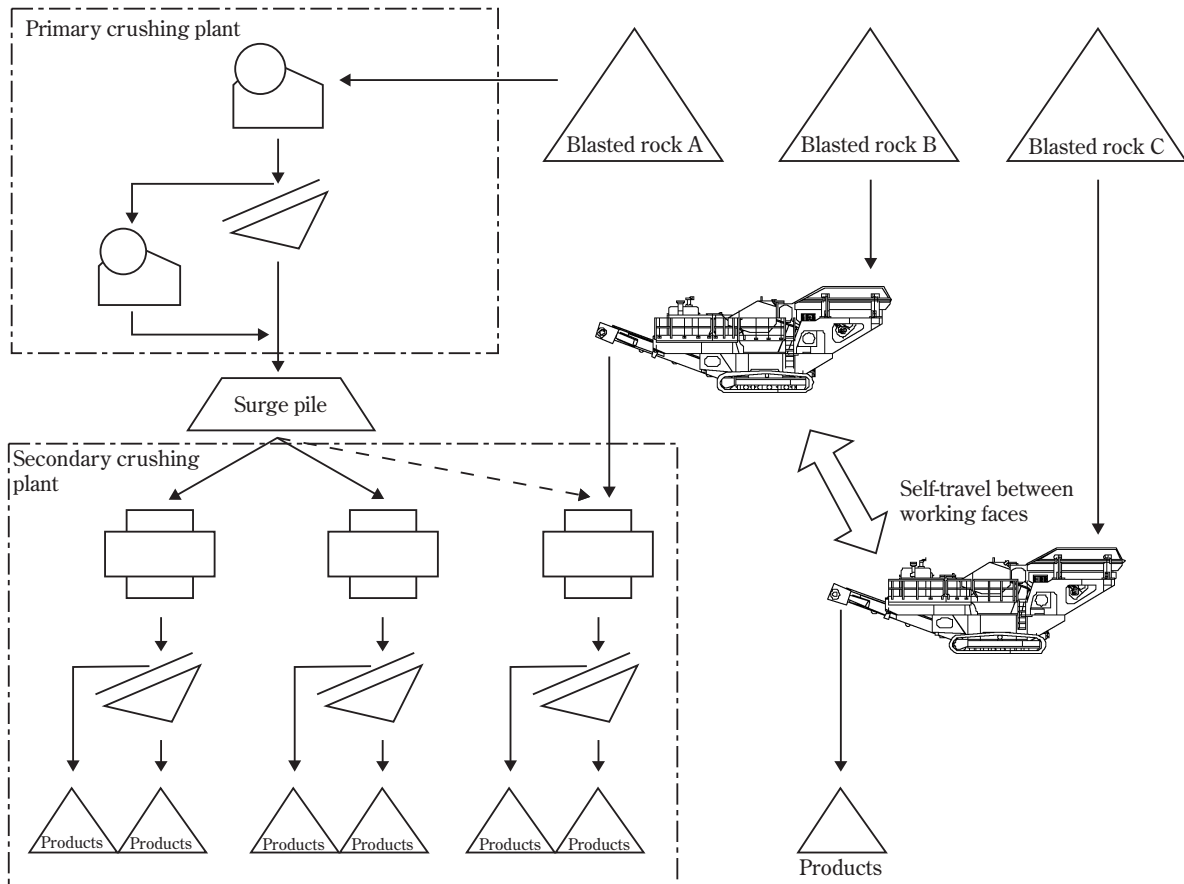


Fig. 6 Relationship between the plant facilities and BR1000JG-1

Introduction of the writer



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[A few words from the writer]

Twelve years have passed since our market introduction of the BR60. Recently, GARAPAGOS has come to stand for mobile crushers in the market, which has already become a general name for this type of machine in the civil engineering and demolishing industries. The BR1000JG-1 that we are introducing at present has been developed as a primary crushing work machine for large scale civil engineering work such as dam construction and quarrying. While machine reliability is strongly demanded in these fields, the two currently operating machines have been working soundly with little interruption, thanks to the machine designers' efforts. Also, this model has been highly evaluated by other users. We will continue to exert our best sales efforts, encouraged by this high reputation.