

An Important Achievement in a U.S. Cement Plant

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Summary

The installation of a mobile toothed roller crusher which can handle widely differing large size hard and dry as well as moist and sticky materials and its technical data are described, as well as the reclaiming machines which recover these products from stockpile. An innovative approach led to an efficient and dependable raw material handling scheme in a cement plant application resulting in low operating costs.

1. Introduction

One of the most important consignments Bedeschi S.p.A. recently shipped to the USA was that for the Alamo Cement Plant at San Antonio, Texas, which included the following equipment (Fig.1):

- a mobile primary crushing unit, Model RG 850 x 1800 (Bedeschi) with a capacity of 800 t/h, skid-mounted
- a portal type reclaimer with mixing blades, Model PAL P 300/20 (Bedeschi) with a capacity of 300 t/h
- a portal type reclaimer with buckets, Model BEL P 100/14 (Bedeschi) with a capacity of 100 t/h.

2. General Information

The crushing unit consists of a hopper which receives material from the pit, an apron feeder with an inclined metal carpet and a roller crusher with toothed rollers and low peripheral speed (Fig.2).

All raw materials to be crushed pass through this roller crusher. Of special interest are the very hard and dry Austin Chalk and Anacacho Marl and the moist, plastic and sticky Eagle Ford Shale.

Austin Chalk and Eagle Ford Shale can have a boulder size of up to 1,500 to 1,800 mm and a maximum hardness of 6



Fig. 1: Crushing and reclaiming area

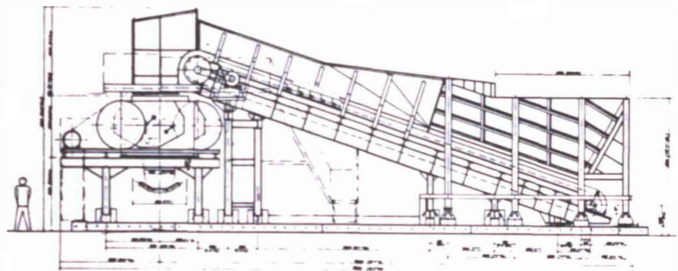


Fig. 2: General arrangement drawing of the mobile crushing unit with apron feeder CNA 14/1800 and roller crusher RG 850 x 2000

Mohs. Eagle Ford Shale can be moist, plastic and sticky with a moisture content reaching 30% at certain times, but at other times almost completely dry.

Using the roller crusher with toothed rollers, on open circle and passing the material through only once, the following size distribution is attained:

Size (mm)	Austin Chalk (%)	Eagle Ford Shale (%)
+ 90	8	1
+ 63	18	6
+ 50	22	17
+ 38	29	22
+ 25	37	30
+ 19	42	36
+ 12	48	42

The crushing unit can achieve an hourly production of over 800 t/h; its perfect operation and versatility in processing both dry, hard materials and moist, plastic, sticky materials is of vital importance to the entire economy of the Alamo cement plant. All raw materials arriving from the pit pass through this single crushing unit.

The specific experience which Bedeschi S.p.A. has acquired in mechanical ore processing has allowed the company to develop this roller crusher and thus resolve in a novel manner Alamo Cement's problems and requirements.

The crushing is carried out on a campaign basis and the various products are transported to the relevant stockpiles from which they are automatically recovered by reclaimers also supplied by Bedeschi.

3. Crushing Unit Features

The various types of material in the open pit are ripped using a crawler type excavator with a single toothed ripper of 600 HP which achieves maximum operational capacity when confronted with the hardest material. Large blocks of material are fed directly into the 30 m³ hopper of the apron feeder by dumpers or shovels.

The apron feeder with a useful width of 1,800 mm allows regular and constant feeding of the roller crusher. It has been designed specifically for heavy wear resistance in order to receive large size material and the blades are hinged to each other over the entire width thus guaranteeing sealing against the finest particles and maximum sturdiness.

The chain with external and internal links is provided with rollers. Apron feeder speed, and therefore output, can be adjusted by means of a variable speed motor. A scraper is installed at the apron feeder discharge head which keeps the surface of the blades clean even when the feeder has to process plastic, sticky and moist materials.

The crusher has two toothed rollers with a differential, low peripheral speed. The rollers are powered independently by two electric motors of 90 kW and 150 kW. The speed of the two toothed rollers is 40 and 60 rpm, respectively, and the power consumption is approximately 0.25 kWh/t.

The low rotational speed of the rollers allows for low wear and tear of the crusher rollers and their teeth. In accordance with the material processed, maintenance of the teeth is carried out at intervals of 6—8 months equal to a passage of one million tons of material.

The main advantages of this type of roller crusher, which has been designed for processing of clays and moist, plastic, sticky materials, but which can crush limestone as well, are as follows:

- low peripheral roller speed
- differential roller speed
- special roller cleaning devices
- low installed power
- low wear and tear and maintenance.

The low peripheral speed facilitates the take-up of material blocks between the rollers and therefore can accept feed of large size.

The differential speed of the rollers allows crushing under the two-fold effect of tangential and compression forces. The

presence of special cleaning devices allows a constant and thorough cleansing of the toothed rollers, especially when the material is moist as is the case when crushing clay.

The three parts composing the plant, i.e., hopper, apron feeder and crusher, are fixed to robust metal support structures. The feet of these structures rest on large metal skids coupled by means of specially sturdy roller shoes. It is thus possible to move the unit on the skids in accordance with the requirements of the pit (Figs. 3 and 4).

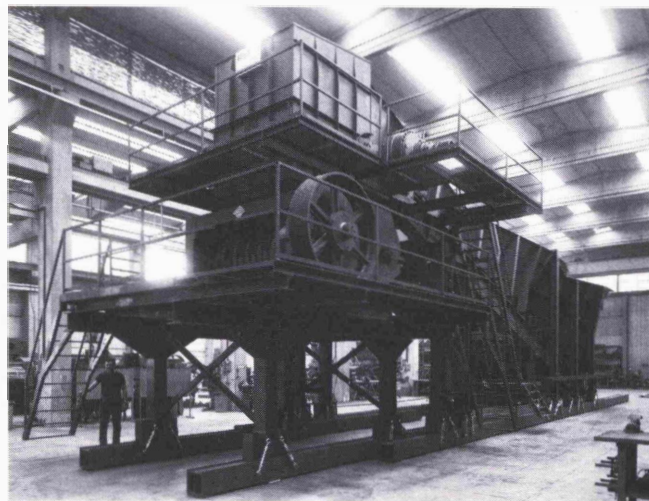


Fig. 3: Shop assembly of mobile crushing unit



Fig. 4: Installed crushing unit

4. Reclaimers

4.1 General Information

Downstream of the mobile crushing unit there are two storage buildings inside which the crushed material is deposited by a system of mobile and reversible conveyor belts.

The dry products are stockpiled in one building and the moist, plastic and sticky material in the other. The span of the first building is approximately 30 m and of the other about 23 m; the maximum heights are 19 m and 15 m, respectively.

Inside these sheds Bedeschi S.p.A. installed two reclaimers of similar structure but using a completely different concept of reclaiming.

In the case of Austin Chalk, where the moisture level is relatively low with about 4—5%, Bedeschi supplied and installed a portal type reclaimer with scraper arm having an output of approximately 300 t/h (Figs. 5 to 7).

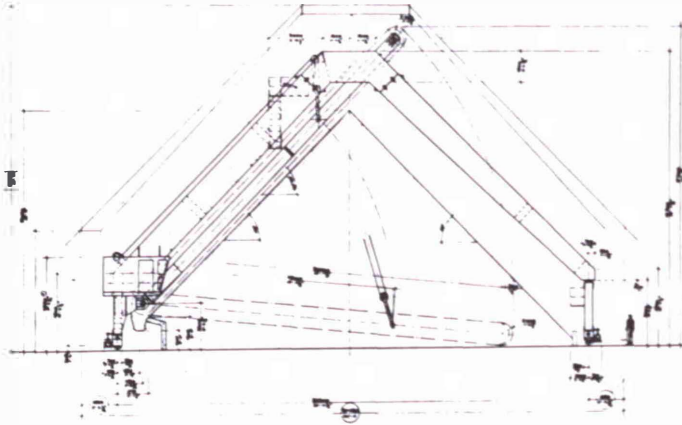


Fig. 5: General arrangement of portal scraper PAL P 300/20

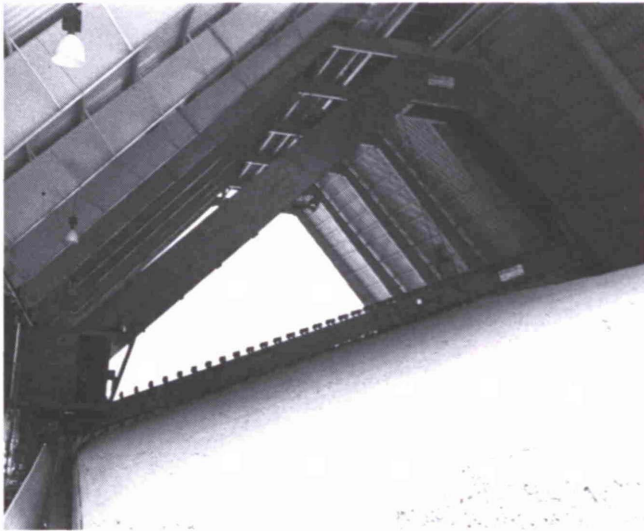


Fig. 6: Portal scraper PAL P 300/20



Fig. 7: Scraper boom

In the case of Eagle Ford Shale, however, where problems due to moisture, stickiness and plasticity exist, Bedeschi preferred to supply, on the basis of their long and tested experience in the field of clay processing, a portal type machine with a bucket arm rather than scrapers. This machine has an output of 100 t/h (Figs. 8 and 9).



Fig. 8: Bucket boom portal reclaimer BEL P 100/14

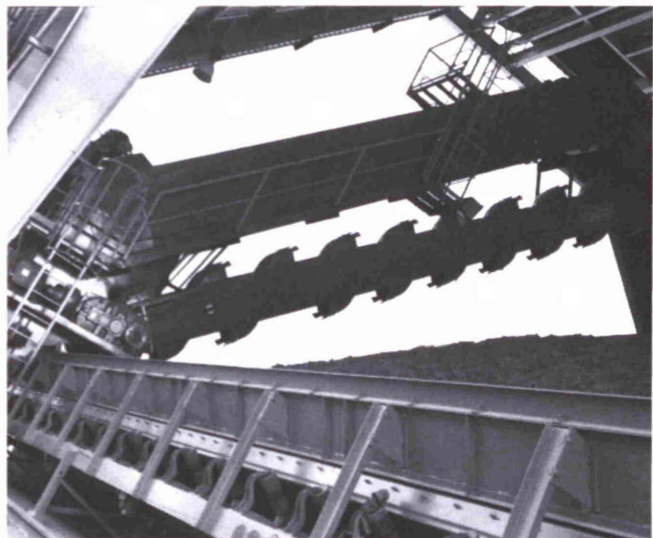


Fig. 9: Bucket boom

The installation is unique and interesting in as much as Bedeschi attached to the support portal a bucket arm which provides considerable advantages when clayey, marl-type materials have to be reclaimed, as is the case with the product stocked in one of the two sheds at Alamo Cement.

The advantage of buckets, in fact, is that it is always possible to completely fill them and to empty them mechanically afterwards at the discharge head point, especially when the material is moist, plastic and sticky. Even this reclaiming arm is provided with the special cleaning device placed at the discharge head which is always applied to Bedeschi's bucket excavators for clay.

The reclaiming machines are completely automated and can be remotely controlled and operated in accordance with the plant requirements prevailing further downstream.

4.2 Technical and Operational Features

Product	Scraper-type portal Austin Chalk	Bucket-type portal Eagle Ford Shale
Size, mm	0—100	0—100
Moisture level, %	5	up to 30
Density, Hms	1.3	1.5
Angle of repose, deg.	45	45
Gauge, rail centers, m	26.5	15
Boom length, center to center, m	20.0	14.0
Reclaiming capacity, t/h	50—300	10—100

The side scrapers move along tracks positioned outside the stockpile and external to the recovery conveyor. Reclaiming is carried out by a scraper arm in the case of clay; the product is then discharged onto a belt conveyor.

The main advantage with these types of reclaiming machinery is that of optimizing the pile cross-section in relation to shed dimensions. Blind spots caused by the passage of the portal, which reflects the external contour of the stockpile building, are minimal.

The portal is of welded, rigid plate construction and at each end trucks for sideways movement are attached. Horizontal thrust wheels keep the machine perpendicular to the runway. Each truck has its own variable speed drive motor to allow variation in output. The reclaiming capacity can also be controlled by increasing or decreasing the pressure of the reclaiming arm on the pile.

The two trucks are synchronised by means of an electric system through a spherical joint mounted on the portal structure itself to avoid torsional stress on the structure.

The alignment system is completely automated; if one side of the portal tends to move too far ahead, its motor auto-

matically slows down to restore parallelism. If, by chance, one of the trucks stops, the other one stops automatically. The entire system is equipped with and fed by cables which slide and loop.

There are two speeds for sideways movement, i.e., a slow speed for the operational phase and a fast speed for rapid movement of the reclaimer inside the storage building.

The reclaiming arm is supported by electric precision winches which allow an exact adjustment of the penetration depth of the arm into the material. The cabin, with all motor controls, is supported on a platform which rests on the truck arrangement on the conveyor belt/arm articulation side so as to provide maximum visibility of the reclaiming operation.

The entire portal moves to and fro automatically, controlled by limit switches positioned on the tracks. Each time the portal movement is reversed, the arm is lowered automatically either by a timer or by a sensor system monitoring the pile height.

5. Conclusion

This plant, taken as a whole, is an extremely interesting example of the way in which a problem can be solved simply and economically. The characteristics of the raw materials are extremely diverse and can vary between dry and hard materials and plastic, sticky material with a moisture content of up to 30%. The initial boulder size can reach 1,500 to 1,800 mm.

A single crusher with two rollers (Bedeschi construction) is capable of processing such widely differing materials, passing these through only once and yet still achieving a final size of 0—100 mm (a reduction ratio of up to 15 times the initial size).

This plant, with its high efficiency, low wear and tear and low power consumption, shows that simple design solutions can lead to low operating costs and trouble free operation.