Harvest of Solar Salt at Salin-de-Giraud France

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ABSTRACT

Situated on the Mediterranean Coast, not far from Marseille, the solar salt-works "SALIN-de-GIRAUD" covers an area of about 11,000 hectares (27,170 acres) and its average production amounts to 90,000 metric tons.

Taking into account the different handling operations necessary from the time of harvesting the salt from the crystallizers until it is refined, packed and shipped (operations which are not all done at the same time), the tonnage of salt to be handled represents about three times the shipped tonnage, i.e., nearly 3,000,000 tons. This handling problem represents an important factor of the cost price of the salt, so the Compagnie des Salins du Midi et des Salines de l'Est has sought for new mechanical means and processes which would render these operations more efficient and reduce their cost.

OPERATION OF THE SALT-WORKS

Briefly, handling of the salt can be summed up in three distinct main operations: harvesting, reclaiming and shipping.

Harvesting of the salt from the crystallizers and temporary stockpiling proceeds continuously for about one month at the end of the production period (from end August to beginning October). The daily harvest rate is about 30,000 tons. Reclaiming from the temporary stockpiles, transportation to the washing plant and final storage follows immediately after the harvesting and lasts about one hundred days at the rate of more than 10,000 t/d.

Out of plant, shipments which are almost entirely done in bulk, are accomplished by truck, train and ships. Harvesting and final shipment operations use transport by conveyors while the reclaiming operation makes use of trucks and conveyors. The choice obviously being adjusted to the distances necessarily covered by the salt between the different handling locations. The three operations are organized as follows.

HARVESTING OF THE SALT

Weather conditions on the French coast of the Mediterranean Sea are characterized by a relatively dry season between the months of April and October. The production of sea-salt is done strictly during this period, and the salt which is deposited on the crystallizers at the end of the season should be harvested as late as possible in order to take full advantage of favorable production capacities before arrival of the rainy season, and then as quickly as possible. At the extreme, therefore, it might be said that harvesting should be done in 5 to 6 days maximum, but it is obvious that considering the tonnages involved, the costs of such an operation would be excessive.

A feasibility study showed that in fact one could do the harvesting in about 35 days if the period was divided about equally before and after September 15th. Accordingly the harvesting has been conducted on this basis, 900,000 metric tons are harvested in 35 days, representing a daily rate of more than 30,000 tons.

When weather conditions have been average, the salt to be harvested reaches a thickness of about 90 mm, which represents about 1,500 metric tons per hectare (1 hectare = 2.47 acres). The crystallizers are constituted by unit length areas of nearly 9 hectares (22.2 acres) placed side by side, the soil of which is thoroughly levelled and compacted and should not be damaged by running mechanical equipment over it which is not specially equipped for this purpose. It was therefore necessary to develop harvesting equipment able to meet this requirement.

New harvesters were designed to pick up the salt over a width of 3.80 m and at feed rates varying from 30 to 60 m/mn, depending on the thickness of the salt layer. The

objective was to maintain an output of 1,600 t/h minimum. This harvesting unit (Fig. 1) consists of a pusher shovel which is inserted between the salt layer and the ground. The salt which is stripped rises continuously as a ribbon 3.8 m wide. This ribbon disintegrates as it falls on the internal face of a conveyor (T 1) which in turn deposits the salt on a second conveyor (T 2) that removes the salt outside. The harvesting device is fitted to a conventional caterpillar tractor, the width of which is such that the tread pressure of the equipment is approximately 0.5 kg/cm^2.

Moving belt conveyors are used to remove the salt continuously supplied by the salt-harvester. If we compare this arrangement with any other type of transport system, for example trucks, it is seen that the light weight of the belt conveyors makes it possible to avoid damage to the crystallizer surface and to ensure heavy and continuous harvest outputs. Lastly, the salt transported by the belt conveyors is brought to the edge of the crystallizers to form temporary stockpiles, this operation being done by an inclined belt elevator.

A harvesting site is composed of two salt-harvesters (Fig. 2), several aligned belt conveyors (unit length 50m) and a belt elevator for the stockpiling. In order to maintain the harvesting rate at its maximum, two harvesters feed the conveyors simultaneously. In this way, any decline in output due to position of the harvesters off-load between each working trip are reduced. When the harvesters have accomplished a pass, the conveyor assembly is moved sideways, each conveyor being self-propelled. When the harvesting has been completed on one crystallizer, all the equipment is moved to another crystallizer, this operation being facilitated by the fact that each element is self-propelled.

Taking in account all these movements, normal breakdowns and accidental stoppages, with this type of organization it is possible nevertheless to reach an average continuous rate of 1,200 t/h throughout the harvesting period. Efficiency is indicated by the fact that a crystallizer of 300m wide with 6 conveyors, requires only 12 men for operation of all the equipment.

WASHING AND STOCKPILING

We have seen that the harvested salt was put directly into provisional stockpiles, which are disposed at the edge of the crystallizers. Before being available for sale, this salt has to be purified by washing.

In some salt-works, this operation is accomplished during harvesting, i.e., without temporary stockpiling, but

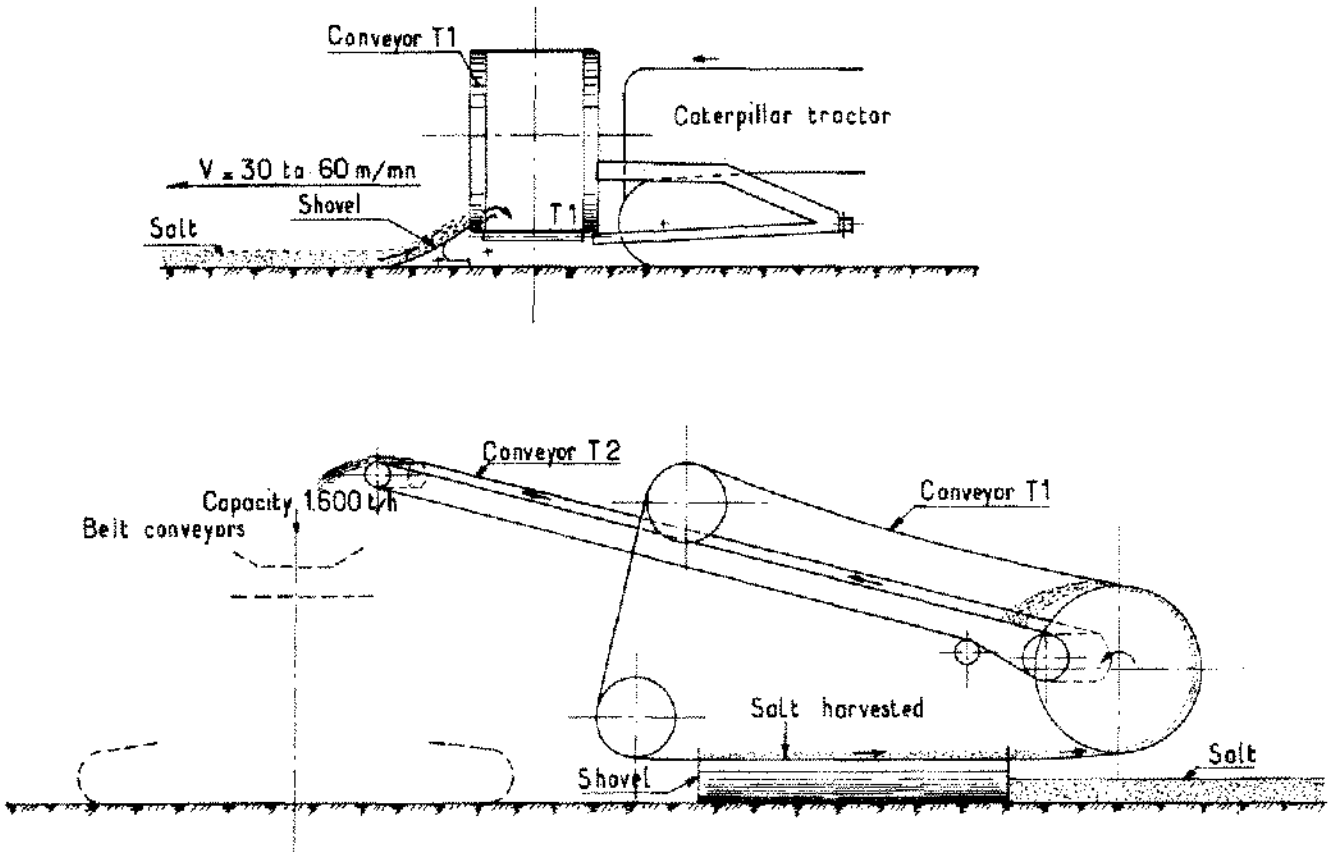

Figure 1. Salt harvester.

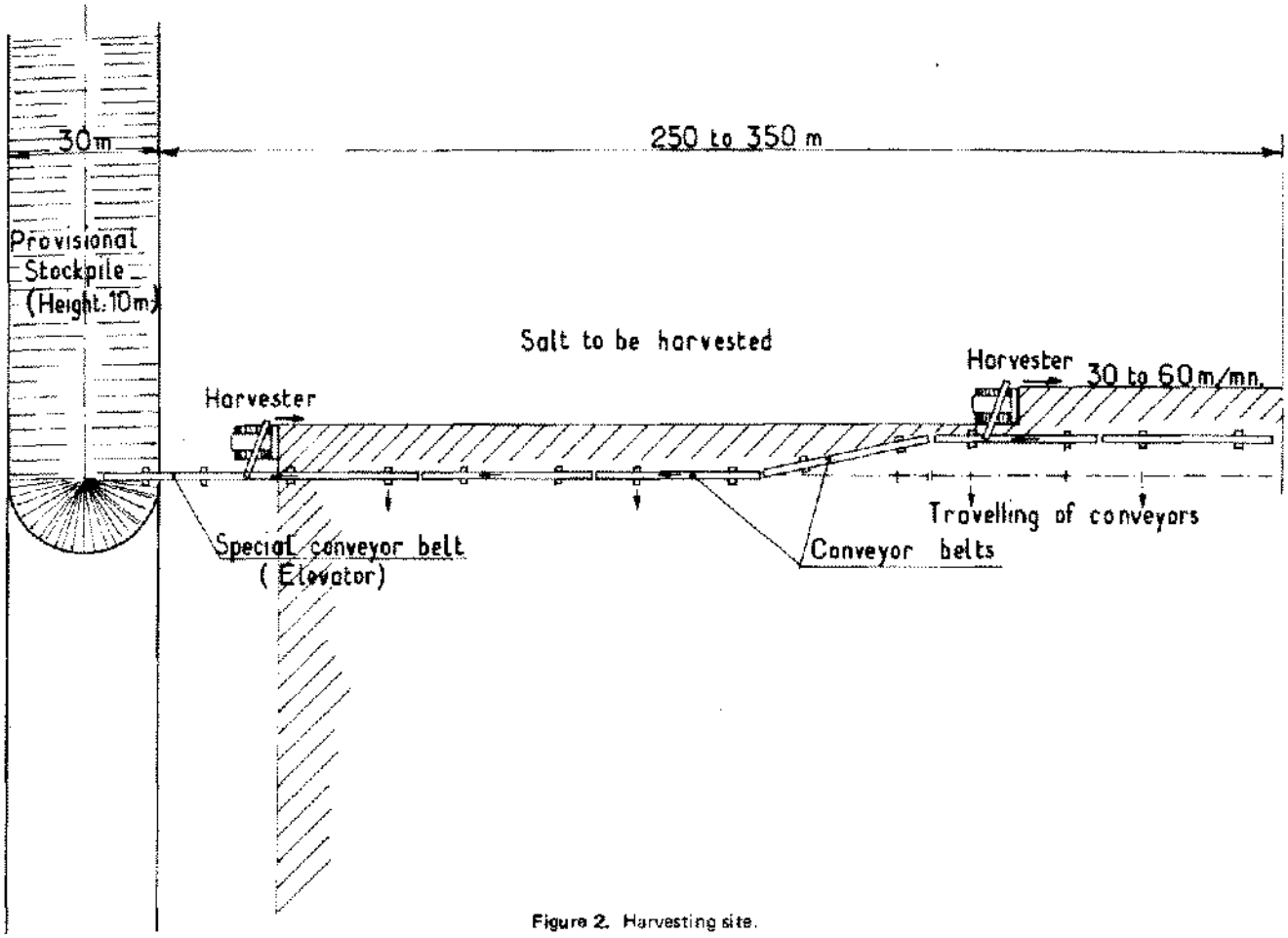

Figure 2. Harvesting site.

this practice has not been retained at SALIN-de-GIRAUD because of the prohibitive cost which would have resulted from transport of about 1,600 tons of salt per hour between the crystallizers and the washing plant situated at an average distance of 2 km. Although the high speed of harvesting is required by the weather conditions, fortunately there is no need to synchronize the washing and the final stockpiling with harvesting operations. Accordingly an average handling rate of 600 t/h was adopted which allows washing of the harvested salt in about 100 days.

The salt is reclaimed from the provisional stockpiles (Fig. 3) by a moving reclaimer, and dispatched to the washing plant by trucks of 25 tons loading capacity. Once washed, the salt is transported to the final stockpile by the same belt-conveyors which were used for the harvesting and the temporary stockpiling.

RECLAIMING FROM STOCKPILE AND SHIPMENTS

Throughout the year, the salt is dispatched to the various users mainly in bulk. The operations are conducted by reclaiming the salt from the final stockpile by a mobile reclaimer which feeds a train of mobile and fixed belt-conveyors which ensure the transport to a large capacity buffer silo. From this silo, trucks, freight cars or ships can be loaded directly and recent statistics show that the salt is shipped approximately as follows: 40% by railway, 28% by road, 26% by ship.

CONCLUSION

The handling organization of the salt operation described here has been studied with a view to rationalization and efficiency in the use of equipment to reduce operating costs. The gain obtained in productivity, thanks to the mechanization has been spectacular.

Similar problems will always arise for this type of salt works and they can be solved in various ways, since they are related to strict requirements which are the climatological limited or unlimited duration of the harvest and the size of the ponds (inland transport distances), each salt-works being different from others according to specific local conditions.

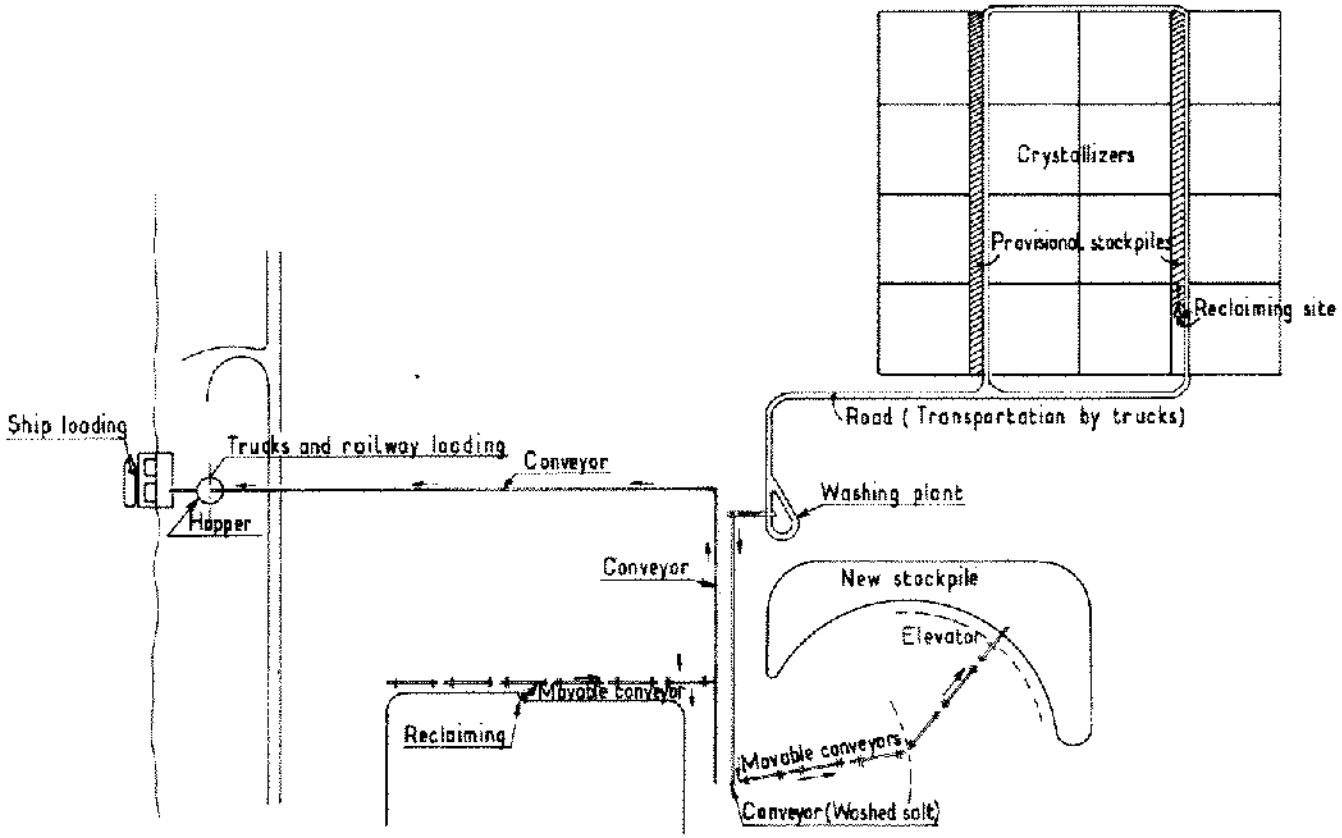

Figure 3. Washing, Stockpiling, Loading.