



DESIGN AND MANUFACTURE NCS INSTRUMENTS FOR CEMENT FACTORIES

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The Ministry level project: " Design and manufacture some of NCS instruments for cement factories" with the aim of domestics a part of instruments and mastering the technology of cement production in Vietnam, especially for vertical shaft cement factories. The gains of the project are:

1. Design and manufacture the automatic control system for cement raw material mixing, connected to components x-ray analyser through serial port of the PC (RS -232).
2. Design and manufacture the automatic discharge control system using gamma rays.

In the year of 2001, general aim of the project is to complete and to correct some disadvantages of existed instruments and to manufacture the modern instruments with high reliability and adaptability for industrial production. The designed instruments are compact, high durability and well operation.

The instruments for controlling the conveyer belt weighing machine can be easily improved for various types of conveyor belt weighing machines. Their mobility and technology software equipped can be adapted for requirements of modern cement production technology, makes the instruments to have technical abilities which is higher than the same types of domestic instruments. Our instruments are operating well in some cement factories and they are helping so much in quality control.

INTRODUCTION

Cement production is a big industrial branch and plays an important role in economy. In present, all technology systems of rotary kiln type cement production in Vietnam are imported, mainly from China. Recently, Vietnamese manufacturers have tried to produce domestically some instruments, but the major parts of these instruments are for vertical shaft type only and other ones for rotary kiln type, which are big in amount, but non-standard and undervalue. To have a thorough grasp of technology and instruments and to reduce of investments in manufacture and maintenance, the improvement of instruments is needed.

1. The instruments for automatic control of conveyor belt weighing machine.
2. X-ray analyser for 2 elements of Calcium and Iron.
3. The automatic control system for the clinker discharge using gamma ray.

The above instruments have been manufactured and to continue improving which follow standard model, high reliability and suitable for present factories situation. The instruments are well designed with high stability and ability.

The instruments for automatic control of conveyer belt weighing machine is well suitable for many various types of weighing machine. By equipping a good technological software follows standards of modern cement production, it became mobile and has technical abilities which is higher than the same types of domestic instruments.

Beside that, online connection between X-ray analyser and weighing machine makes the system to become highly automated, systematized and competitive.

INSTRUMENTS OPERATION PRINCIPLE

1. The instruments for cement raw material mixing.

This instrument is one of the most important instrument in cement production chain and it has a major influence to clinker quality. This one is a combination of the conveyer belt weighing machine, technological software, composition control software and weigh machine control software. It also can be connected to fast element analyser to make the instrument can operate online.

The instruments also can be used for high productivity rotary kiln cement factories. In these situations, all of the system can operate fully automatically.

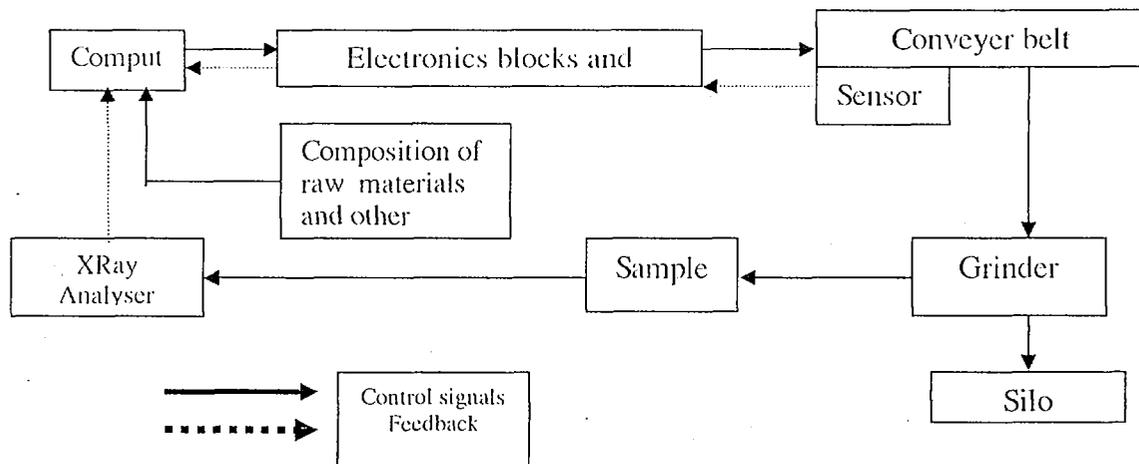


Fig 1. Block diagram of system for automatic control of conveyor belt weighing machine

In fig. 1 is an illustration of a system in operation. The qualitative control of input raw materials of mixer is done on a continuous conveyer belt weighing machine with a software for controlling and stabilizing based on signals from loadcells which are put on the weighing machine and signals of weighing machine velocity. The major control process is control belt velocity based on present raw material flow on the belt to fix mass velocity to preset value. This system is helpful to stabilize composition of raw material.

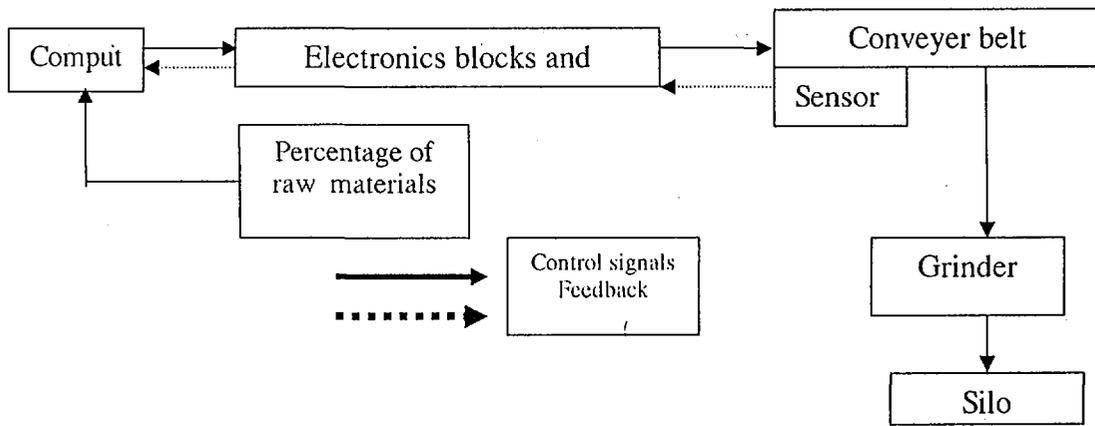


Fig 2. Block diagram of control system based on percentage of materials

In fig. 2 is an illustration of a cement raw material grinding control system based on percentage compositions of some domestic manufacturers. Until now, there is no domestic manufacturer could produce the system for automatic calculation and automatic stabilization of cement raw material based on analysed chemical results of the raw material and the percentages of these elements are determined in experiences only. Those calculations must be done manually and take a lot of time.

The automaticize all operations in fig. 1, a block diagram in fig. 3 was designed by the project group.

From physical parameters and percentages of oxides in the input raw material, a downstream calculation process can calculate percentages of elements and clinker. The calculation will give out requirements of weighing velocity values for each conveyer belt. After grinding the raw material, the output powder is analysed to check chemical composition. These results are fed into PC and a upstream calculation process will calculate , compare, control and give out new requirements for control system.

Input's parameters:

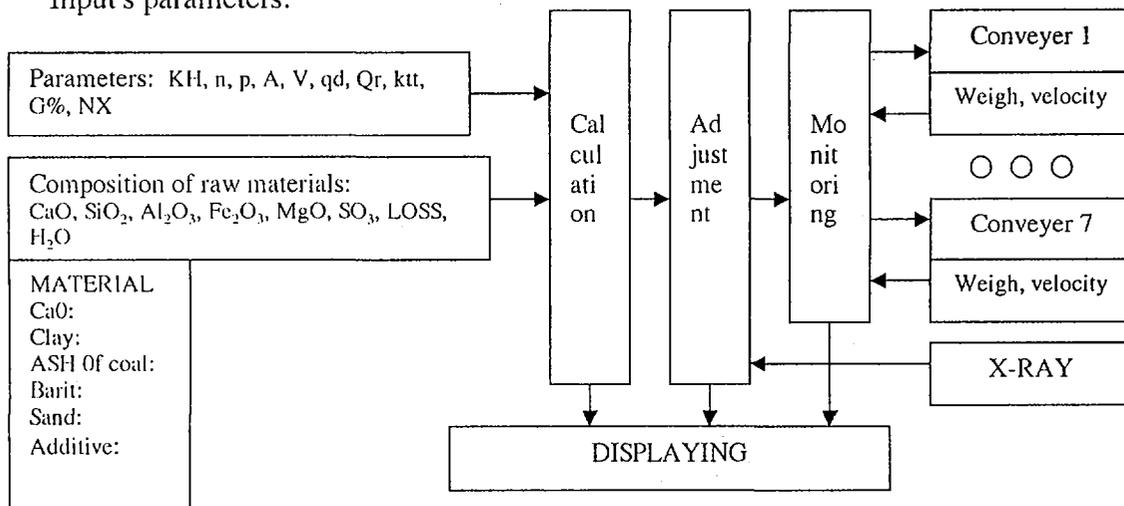


Fig 3. Block diagram of control

The software will do downstream and upstream calculations. Its algorithms are created by experts of Construction Science and technology Institute. It was tested well in

Hoang Thach cement factory. The software and control system have made major contributions for getting exact percentages of raw material. This control system receives 2 signals of weighing and velocity of the belt to process and control velocity suitable to get a required productivity.

It can be said that a good combination between technology, controlling and stabilizing problems have made a high reliability for the system.

2. The automatic discharge control system using gamma ray.

The sensors and objects of this instrument is under the kiln and its own control unit is in control room. This one plays an important role in operation of the kiln.

The kiln has a rotational switch for discharge continuously clinker with wind flow control unit to control its operation. It also has a continuous rotation discharge equipment and an automatic clinker discharge controlled by instrument using gamma rays. This kiln system is to ensure a continuous operation in which the raw material inside can be moved continuously, so technological zones such as dry zone, heating zone and cooling zone are created. This continuous operation also ends the discrete discharge which wastes much of heat.

The advantage of this system is the operation to keep an automatic clinker discharge in production process, so it helps so much for avoiding accidents. In the case of manual operation, the probability of the above out-of-control discharges is very high and could lead to accidents and broken in production process. In contrast, a under control level discharge could reduce productivity.

Since characteristics of discharge stage are: operation under high temperature, dusty, strong vibration... condition, only level gauge using nuclear technique can adapt those requirements. So this system can be the most important element in factories using vertical shafts, especially in safety approach. This is also an advantage of using nuclear techniques.

3. The fast elemental analyser of Calcium and Iron in raw material

Analysing elemental composition uses two methods. Convenient method is chemical analysis that takes time of typically 30 minutes per analysis. So if multi-element analysis is needed, it will take so much of time and more for upstream control. The second method is fast X-ray analysis. In factories using rotary kilns, modern X-ray analysers can analysis many elements, among those, typical elements are Ca, Fe, Si and Al. And in some factories using vertical shafts, two components X-ray analysers for Ca and Fe were imported from China. These analysers take time of typically 2-3 minutes, so much faster than the first method. However, these Chinese made instruments have raised some disadvantages in operation such as difficulty in using, not stable in operation of electronic system etc. so almost of these instruments are not used in the highest efficiency. To help factories in using these efficiently, we have improved this single channel type analyser to become multichannel spectrum analyser. The block diagram of this system is shown in fig. 4.

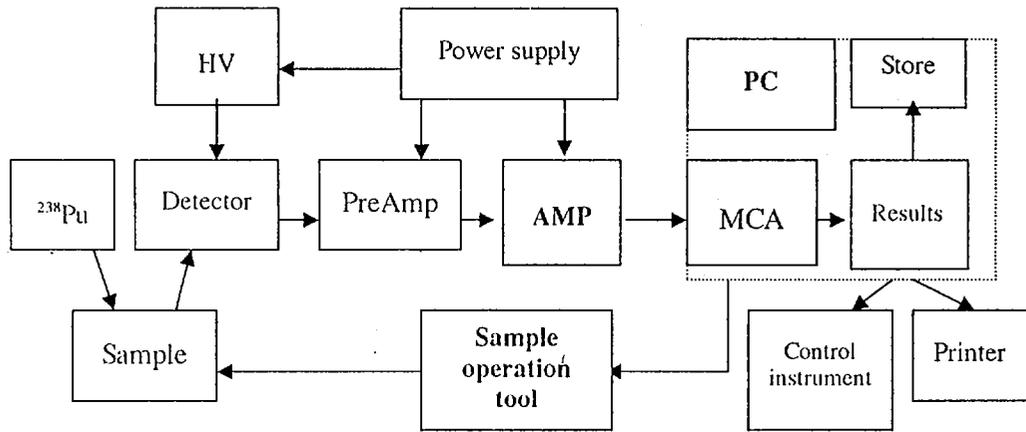


Fig 4. Block diagram of Xrays Analyser

This is a basic improvement to change the production quality and technology in vertical shaft cement production technology. The automatic electronic system has ensured vertical shaft cement production chains to operate stable and in good clinker heating conditions, basically.

THE ACHIEVEMENT RESULTS

Since 1998, Institute for Nuclear Science (INST) and Technique and Institute for Science and Technology of Building Materials (ISTB) have co-operated in research developments, those above instruments were designed, manufactured and equipped for many cement factories. After end of two projects: "Design and manufacture the automatic calculation and control system for cement raw material " (RD32, ISTB-2000), which had completed the technology problems; project " Design and manufacture NCS instruments in cement factories" (BO/01/04-04, INST-2001), which had completed designs and manufactured those instruments. They are continuously improved and performed. Presently, These instruments are operating reliably in factories such as Chieng Sing (Son La province), Kien Khe (Ha Nam province), X78 (Defense Ministry), etc.

CONCLUSION

Three above instruments are playing important roles in cement production chain. The second one can be also the most important thing in vertical shaft technology. Therefor all of three instruments have high applicability in realistic conditions and they are suitable for industrial requirements. However, with the aim of spreading their applications, it will take a lot of time for contacts between instruments manufacturers and factories which have needs to use them, and also it needs useful guidance from state administrations in technology transfer and scientific applications.

REFERENCES

1. Report of the project results 2000-Ministry of Construction (RD32).
2. "Some major resolutions for improvement production quality, instrument efficiency and production efficiency in vertical shaft cement factories". Nguyen Van Ngoc, in Conference "Technical resolutions for improvement productivity and quality of vertical shaft cement", 5/2001, Institute for Science and Technology of Building Materials, Ministry of Construction.
3. Report of the project results 2001-Ministry of Science, Technology and Environment (BO/01/04-04).
4. Practical radiation safety manual. Manual on Gamma Radiography. IAEA 1992.