CONTROLS FOR BETTER GRINDING

THERMOSTATIC CONTROL

Thermostatic temperature controls can be valuable additions to jacketed Mills. Frequently, on jacketed Mills without these controls, Mill temperature varies tremendously depending on the season of the year, the time of the day, and the length of time the Mill has been operating. Where temperature varies so widely it is to be expected that quality of product, production, and power costs will be affected adversely.

In the cases of water-cooling jackets, prior to the installation of the thermostatic control, it had not been known whether water was necessary on cold days, and, consequently, the operator would let the water pass through to be on the safe side. This meant that the viscosity of the batch was never allowed to become low enough to insure proper movement of the balls and pebbles, which seriously affected the grinding efficiency of the Mill.

In the wintertime the room temperature in many plants runs as low as 60º and in summertime as high as 100º. Water departments tell us there can be a difference of 50º in water temperature. Therefore, the need of controlling Mill temperatures is obvious. The most practical way to do this is by the use of thermostatic controls.

Thermostatic controls are also recommended in cases where either steam, hot water, or hot oil is used to maintain fluid consistency of products which tend to solidify when cool.

There are many advantages to be gained by the use of thermostatic controls on jacketed Ball Mills and Pebble Mills.

1. Grinds can be kept uniform throughout the year regardless of seasonal changes in temperature.

2. Savings will be realized in water or any other media that is being used for temperature control.

3. Scheduling problems can be alleviated, due to more accurately controlled grinding time.

4. Good grinding practice means lower costs in power and less unnecessary wear on equipment.

5. There will be less danger of batch contamination, a frequent result of improper consistencies.

6. Chances of batch spoilage will be lessened.

A typical thermostatic control unit operates as follows when used in a water-cooling jacketed Mill:

The jacket is kept filled, with a slow trickle of water constantly passing through it. A thermostatic element, which controls the cold water valve, is placed on the discharge side of the jacket. No change in the slow trickle of water takes place when the Mill is started. The batch must first warm up to a point where it begins to affect the temperature of the water in the jacket. When a predetermined temperature is reached, the thermostatic element calls for colder water, the cold water valve then begins to open up permitting additional circulation of the cooling medium through the jacket, thereby drawing off any excessive heat that has begun to develop in the batch. When the temperature in the batch falls below this predetermined point, it is manifested in the jacket and the valve begins to close.

As long as the Mill runs, the thermostatic control feeds and cuts off the eater supply as required. In warm weather and in cases where feed is on the high side, the flow through the jacket would be at a much higher rate than in cold weather. Conversely, in cold weather water circulation is unnecessary in many instances.

Similar arrangements can be adapted to Mills where a hot media is circulated to keep batches of some materials sufficiently fluid for good grinding.

By installing such a control on all jacketed Mills where temperature might ordinarily vary and affect results, a progressive step in controlling the grinding variables will have been accomplished. The nominal cost of the installation should quickly pay for itself in better production, quality of product, and more economical grinding.

REVOLUTION COUNTERS

Revolution Counters provide a simple, accurate method for controlling grinding and mixing time. In addition to recording actual grinding revolutions, they may be used to count revolutions, when the Mill is being cleaned, an operation in which revolutions should be very closely checked to avoid wear and contamination. Counters also can prove extremely helpful in case of a power failure, say at night, when the Mill would be running unattended. A counter will tell exactly at what stage of grinding the batch was when the Mill stopped.

Reset counters are commonly used, being easy to operate and very flexible in application. Often, however, a predetermined type of counter is preferred. In this case, the Mill is set to run for a given number of revolutions, at which time an electric mechanism in the counter automatically stops the Mill or sets off an alarm so that an operator may do so. With preset counters, the human error probably has the least chance of creeping in.

BLACKBOARD WATCHMAN

A VERY COMMON, SIMPLE METHOD OF KEEPING TRACK OF mill running time, and yet one which is sufficient in many cases, is the “blackboard watchman.” The “watchman” consists merely of a blackboard near the mill on which starting and stopping times are written.

This method of controlling Mill operation has several obvious disadvantages. Trouble might be encountered in case of power interruption at night, where the Mill would be stopped after a certain indeterminate period of operation. Other troubles might be experienced due to human errors or negligence. In a majority of instances, however, the blackboard watchman has proven entirely adequate.

INSTRUMENTS FOR MEASURING VISCOSITY

Viscosimeters may generally be classed under one of the four following types: air bubble, falling weight, torsion, or efflux.

The air bubble type of viscosimeter consists of a tube closed at both ends, of standard internal diameter, and filled, except for a small bubble of air, with a liquid of known viscosity. When the tube is inverted, the time required for the bubble to rise is proportional to the viscosity of the liquid.

In finding the viscosity of the unknown, an identical tube is filled with the unknown and a similar size bubble is created in the tube. The rise of the bubble in the tube can then be compared with those in the tube or tubes of the various liquids of known viscosities. The Gardner-Holt model is a popular air bubble viscosimeter.

In the falling weight type of viscosimeter, viscosity is measured by dropping a steel ball in a vessel containing the fluid and measuring the time it takes the ball to fall between two elevations. This method probably gives a fairly accurate measure of viscosity in the case of very viscous liquids. It is used extensively in the lacquer industry.

A simple viscosity test which gives a rough indication of a good "first trial" grinding consistency is made as follows: Attach an average size pebble or ball from the Mill to a tin wire (say .010 diameter). Fill a tumbler with the paste mixture to be ground, and place the pebble or ball on top of this material. If it takes from one to three seconds to settle through a 6 inch depth of material, (using the wire to judge the time of fall), the consistency is about right. Further refinements may be made later, based on actual performance of the Mill.

In the torsion type viscosimeter, a cylinder or disc, or paddle is suspended in a cup of the fluid and rotated. The resistance that the fluid offers to the rotation of the immersed body is an indication of the viscosity. The Stormer viscosimeter is this type of instrument, in which a paddle is used, and the force of a falling weight turns the paddle. Other types of torsion viscosimeters include the MacMichael, the Doolittle, and the Brookfield Synchro-Lectric Viscosimeter.

A great variety of instruments of the efflux type are in use today, although they all work on the same principle. The time required for a given volume of the fluid to flow out of a tube or cup through an orifice at a certain temperature measures the viscosity. Instruments of this type include the Saybolt, Redwood, Engler, and the Ford Cup.

Whatever device is used for measuring viscosity, the most important thing is that good, consistent testing procedure be used. All tests should be made under the same conditions. This will help eliminate variables and inaccurate or inconsistent results. In some cases specific gravity as measured by a hydrometer has given an indication of consistency which, applied the same way each time, was satisfactory for the particular material involved.

TIMING DEVICES & AUTOMATIC TIME SWITCHES

Timing devices similar to those used on kitchen stoves or in developing photographs may be used to control Mill operation. They may be spring operated, as in the examples given, or electrically operated. They are usually started when the Mill is started and are set to run for the entire grinding time of the batch. When this time has elapsed, the timer sets off an alarm which indicates to the operator that the Mill should be stopped and discharged.

Automatic time switches are electric timing devices which may be wired to automatically shut off the Mill motor at the completion of the prescribed time. This relieves the operator of some responsibility and reduces the possibility of irregular batch times due to human errors.

Electric timers should be installed with the synchronous motor of the timer hooked up to the running motor of the Mill. Then the timer will run only when the Mill is actually turning. Setting up these timers to operate independently of the Mill is not recommended. If this is done, stopping the timer may be forgotten when a Mill is stopped for any reason. Or, if the timer is stopped, the worker may forget to start it again when the Mill is restarted. Power interruptions, lubricating crews, or anything else which may cause Mills to be shut down briefly during a single run may introduce timing inaccuracies.

Timing devices and automatic time switches are made by many manufacturers of electric controls. It is advisable when choosing a timer, however, to anticipate the longest running cycle which might be encountered (over a weekend, for example), since many timers have maximum time limits which are only twenty-four hours or less.

PRESSURE CONTROLS

The use of pressure controls is a very important requirement in the operation of Mills where compressed air, water or steam is being used. Mills are built to operate under the most severe conditions, but there are very strict state and insurance laws governing pressures that can prove troublesome to anyone who does not conform to them.

Many firms depend upon the operator to control the pressure. This is always guesswork. The only positive guarantee against excessive pressures is a suitable regulator. These are not costly to purchase or install, and they definitely eliminate guesswork. Instances have been observed where it had been thought that a nominal amount of pressure was going into a Mill. After an expensive breakdown, it was discovered that the actual pressure which was used exceeded any reasonable working limits.

A pressure control system is recommended whenever compressed air is to be used for unloading the Mill.

It is very easy when unloading with compressed air to let the air pressure get too high for safety. In all cases where this method of discharging is contemplated, the Mill manufacturer should be advised of this fact, and told what air pressures are to be used.

Instances are known where from 150 to 200 pounds of pressure were used, unknown to the operator, who had no way of measuring or controlling it. Such practices are extremely dangerous, and may lead to Mill failure and injuries to personnel.

MEASURING FINENESS OF WET MATERIALS

The Hegman gauge is a very simple and practical gauge for testing the fineness of paint and other wet ground products. It is designed to measure the wide range of fineness between the extremely fine industrial enamel for refrigerators and similar products, and the coarsely ground house paints and primers.

The standard gauge is a precision machined steel plate, the center panel of which is tapered in depth from a slight to a deeper depression. A gob of the ground material is placed in the tapered part of the center panel and wiped down with a doctor blade. Fineness is determined by holding the gauge to the light and observing the area where the coarse particles begin to appear. The sides of the gauge are marked to indicate the fineness along the area of the tapered depression. A gauge may be marked in the North Standard Scale (0-8) or the New York Production Club Scale (0-10) or both. Some modification can be made to suit special conditions.

The product is usually thinned to a consistency of about 1000 centipoises, rather than an extremely heavy paste or thin liquid. Best results are obtained when the consistency is held uniform for any given type of product.

Any plants or industries which are concerned with the development of a standard method for testing a wet ground product may find this gauge useful.

PILOT PLANTS

A useful method of obtaining coordination between laboratory findings and the production Mills is by the use of a pilot plant. This consists of small Ball or Peddle Mills in which laboratory discoveries can be tested to determine their practicability for full scale production without interrupting the actual production Mills. Production men should not be compelled to stop their work in order to test new formulations; nor should improvements in production be lost because the laboratory men have no means of demonstrating their discoveries.

On the other hand, the pilot plant should not eliminate the need for the laboratory Mills for several reasons. In grinding, the amount of material required for a pilot plant is considerable. From the standpoint of economy alone, it is advisable to start with minimum quantities in the laboratory. Also, running all experiments through the larger pilot plant Mills might curtail the amount of research which could be accomplished using the smaller, more convenient laboratory Mills.

Any laboratory results can be duplicated in production Mills, though some minor changes may have to be made to allow for the differences in the sizes of the Mills. When a pilot plant is used and some changes are needed, everyone knows it before the production plant is reached. One incorrect batch of material in many industries could be more costly than the entire equipment of a suitable pilot plant. One valid idea passed up for lack of it would also represent a loss. There is a place in progressive industry for both the laboratory and the pilot plant.