Electrostatic Precipitators for Recovery Boilers

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Electorostatic Precipitators play a very vital role in the Paper and Pulp Industries. Besides preventing air pollution it helps in recovering valuable chemicals, which can be reused in the pulp making process. (In any Paper and Pulp Industry, greatest potential losses are by way of the flue gases from Soda Recovery Boilers, when spent liquor is burnt). The high combustion temperature causes vaporization of a large part of the chemicals, which are sublimated to form very fine dust particles in the flue gases. Naturally all the Paper and Pulp Industries have turned to electric precipitator, which makes it possible to recover from the flue gases 95 to 98 percent of the contained alkalis. Although wet collectors are sometimes used, electrostatic precipitators, because of their superior performance are regarded as a standard equipment all over the world for this type of application. One of the world's largest group dealing with such type of equipment is the SF Group, originated from M/s. AB SVENSKA FLAKTFABRIKEN, Stockholm, Sweden, now operating as world headquarters. The SF Group covers a wide part of the world and in India, it is represented by SF India Limited, the operational headquarters has been located at Calcutta.

As early as in 1939, SF manufactured and put into commission the first electrostatic precipitator for Soda Recovery Boiler. Subsequently, encouraged by the success, many more precipitators were installed. This was possible because of the facility available for carrying out the extensive research and development work in our upto-date Laboratory in Sweden. Studying of optimum gas distribution the mechanical strength of the electrode fixtures and rapping mechanism, measurement of the current and voltage characteristic of the different types of electrodes, testing their ability to resist damage due to flash over and many such fullscale testing on discharge and collecting electrodes are being constantly carried out in the laboratory, to ensure the best performance. We being a group company, get the benefit of all these research work carried out in our world headquarters in Sweden. This gives us the opportunity to manufacture here in India the most modern plants with upto-date design features.

A brief description of the main design features of SF Electrostatic Precipitator is given below :-

1. **Casing**

The casing for SF electrostatic precipitator is made from sheet steel or concrete. Due to corrosive nature of the flue gas from the recovery boiler, normally concrete casings are employed. Casings are further insulated to prevent condensation of gas inside the precipitator.

2. **Gas distribution screen**

Gas distribution screens are employed at the entrance of the precipitator to distribute the flue gases throughout the entire cross-section of the precipitator. Nowadays SF Precipitators are equipped with two gas distribution screens to obtain optimum gas distribution. A separate rapping mechanism utilising tumbling hammers is used in order to avoid dust build-ups and changes in the distribution originally obtained.

3. **Emitting system**

Each electrical section of high voltage system hangs from four supporting insulators through steel tubes, which carry beams supporting a number of frames fixed in the centre of each gas passage. The entire high voltage framework is thoroughly braced and forms rigid box like structure, Fig. I. The emitting electrodes consist of hard-drawn spiralised stainless steel wires, Figure-2. These are delivered to the site in the form of coils with hook attachements fitted at each end. At site these coils are stretched and anchored between the high voltage systems by means of hooks. Following are some of the special features of this type of electrodes :

a) The spiral form of the electrodes gives rise to a number of evenly distributed points, from which corona discharge takes place.

b) They are self tensioning, thus

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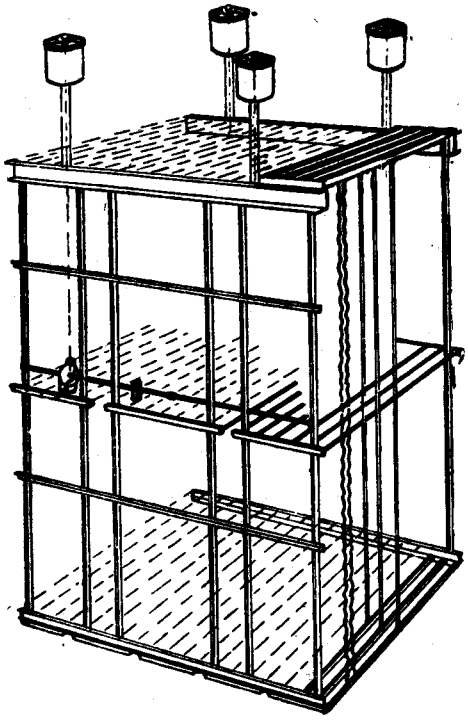

Fig. 1. Emitting Frame Work.

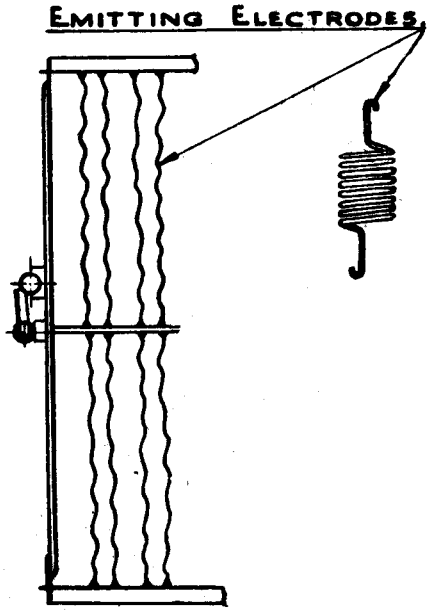

Fig. 2. Emitting System and Emitting Electrodes

no weights are required to keep the electrodes hanging.

4. **Rapping mechanism for emitting system**

The rapping mechanism incorporates tumbling hammers mounted on a horizontal shaft in a staggered fashion. These hammers strike the shock beams to which the intermediate part of the emitting frame of each passage is attached. In this manner the vibrations developed by the hammers are transmitted to the emitting electrodes.

5. **Collecting electrodes**

The collecting electrodes are made of cold rolled mild steel plate. They are equipped with hooks at the top from which they hang eccentrically in the roof construction of the casing. At its lower end, each collecting electrode is provided with a shock receiving iron. Each individual electrode is of a limited width generally 400 mm, and a number of such electrodes make-up one collecting section. The electrodes in one row are connected to each other through shock bars located under the collecting electrodes. The shock bars hang from the first and last collecting electrodes in each row, Figure-3.

6. **Rapping mechanism for collecting electrodes**

The rapping mechanism employs tumbling hammers mounted on a horizontal shaft in a staggering fashion with one hammer for each shock bar. The shaft rotates slowly, each of the hammers over-balances in turn and strikes its relevant shock-bar. The shock bar transmits the blow to all the collecting electrodes in one row and because of their metallic contact with the shock bar,

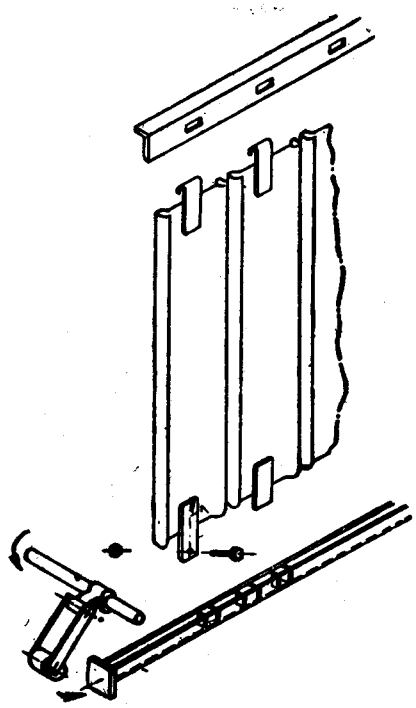

Fig. 3. Collecting Electrodes With Shock Bar and Tumbling Hammer.

each electrode in the row receives the shock simultaneously thereby providing uniform rapping effect along with the entire row of the collecting electrodes. The advantages with this type of rapping mechanism can be summarised as follows :-

a) Fast acceleration is ensured in all parts of the collecting surface.

b) Only a small portion of the total surface area of one precipitator is rapped at a time. In a large precipitator plant the percentage may be as low as 0.2%.

7. **Dust discharge arrangement**

Due to the sticky nature of the collected soda the precipitator is generally provided with a flat bottom to ensure a proper dust discharge and a minimum maintenance problem. The present dust discharge design,

Figure–4, incorporates one or more parallel scrapper units each with two chain links, driven from the inlet end. The dust is discharged into a drag link conveyor running perpendicularly to the gas flow which in turn discharges dust via a rotary feeder into the black liquor tank. The drag link conveyor is preferable to a screw conveyor due to there being less risk of over–bridging and fewer mechanical forces being applied to the dust. All drives for the transport of the dust are equipped with over–load couplings and rotation relays. If one shaft stops, all the proceeding motors including those for the rapping mechanism for the collecting electrodes are stopped and a signal is given.

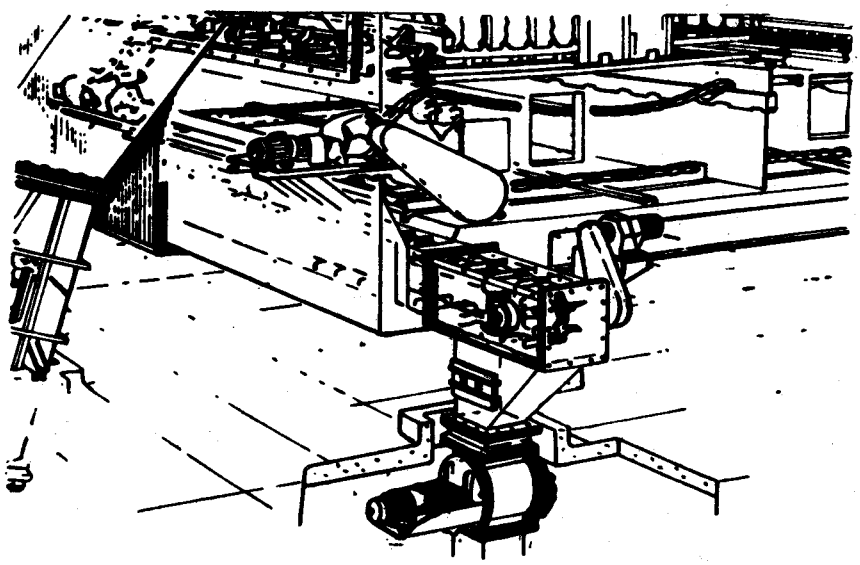

Fig. 4. Flat Bottom Dust Discharge Arrangement

Since 1957 SF has supplied a number of electric precipitator plants for a total gas quantity of around 550,000 m^3/hr. in the various paper and pulp Industries in India, for such application. Besides this one more electric precipitator (having gas handling capacity of 120,000 m^3/hr.) is under installation at Harihar Polyfiber Project, which contains as much as 80% indigenous components. Due to the special application, certain components such as stainless steel emitting electrodes, heating elements and theromostats, speed monetors, insulators, special sprocket wheel for redler conveyor etc., are required to be imported. With the subsequent development of these items in our country, it will be possible to further reduce the percentage of the imported components in the near future.