Instrumentation in Continuous Pulp Stock Preparation Plant

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The scope of this article is to give a general idea on application of modern instrumentation in a continuous stock preparation plant. Instrumentation has made significant contribution towards uniform furnish to the paper machine at changed G.S.M. and machine speed, minimising time losses in such changes, maintaining uniformity of product quality, gaining in production by reduction in broke percentage, etc.

Bleached and screened pulp from Bleach Plant is dumped into two unrefined stock chests in stock preparation plant. These chests are provided with directly mounted flanged type level transmitter. The level is measured by the static pressure of stock head on the inner side of the diaphragm of level transmitter and balanced equivalent air pressure output is delivered to a panel mounted recording controller from the other end of diaphragm. 20 psi air supply is given to the restriction unit and bleeding through exhaust port is controlled by pressure on diaphragm by pulp stock. In a balanced condition, the diaphragm just remain floating on the bleed port, consequently the output air pressure is the measure of level inside the chest. These two chests are alternately filled up. While one is being filled up, the other is drawn out and vice versa. This cycle of operation is controlled by limit set points on level controller which opens or closes in proper sequence the cylinder operated ON-OFF gate type plate valve on the chestconnecting piping leading to the suction of the stock pump. This process of filling and emptying of the chests are controlled automatically by the controllers.

The unrefined stock is now pumped through a set of refiners. Prior to its entering the refiners, a consistency controller controls the consistency of stock to the refiners. The Consistency controller incorporates a rotating sensing element driven by electrical motor. It is imperative that at the point of installation the velocity or impact force is to be nullified only the frictional force of the pulp stock needs to be measured by the sensing element to evaluate stock consitancy. This later force is transmitted through the torque arm which with the help of pilot relay converts the torque into proportional pneumatic output impulse. This impulse is recorded in the Recording Controller and according to the setting index on the controller, the dilution on the suction of the stock pump is controlled through a diaphragm motor operated control valve. The mode of control applied is generally proportional plus integral action.

Stock travelling through a set of refiners to attain the optimum OSR of freeness is ultimately directed to a Refined stock chest. This chest is provided with a level Recording controller similar type as explained earlier. The level of this chest is controlled by setting the control setting index to a particular level of the chest. The mode of control applied is proportional plus integral action. The control output pneumatic signal from the controller is impressed on the valve positioners of two control valves. One of these two control valves is direct acting and the other is reverse acting type. The modified loading pressure from the valve positioners controls valve opening and closing, whatever the case may be. These valves are positioning type and the significance of providing these two valves is to control level in the chest as well as not to interrup the usual operation even in case of high level inside the Refined stock chest. To explain this, take it for a while that the chest level is low as compared to desired setting index, consequently the valve catering pulp to the chest will open more, simultaneously the valve diverting pulp to circulation will get proportionally closed. On the contrary, if due to some reason or other, say less draw from the chest, the high level will actuate the chest feeding valve to close and likewise circulation valve to open more.

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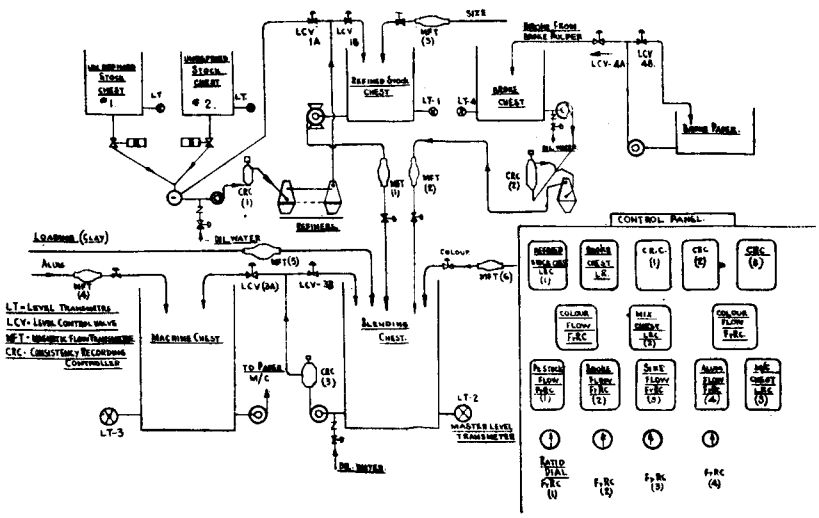

Fig. 1. Flow sheet showing instrumentation in Stock Preparation Plant.

These valves are V-plug axially rotating type with 90° angular travel.

Now this refined pulp is pumped from this chest to the Blending chest through a magnetic flow transmitter and a diaphragm operated Saunders type valve with valve positioner. We shall revert back again to this flow transmitter and control valve while describing Blending chest controls.

Paper broke after repulping in a broken pulper is transferred to a Broke chest. This chest is provided with a level controller controlling actuation of two control valves. These valves are Saunders type diaphragm motor operated incorporating valve positioners. As explained earlier, the mode of operation of one being direct, the other reverse acting. Now broke from the chest is transported by a pump after consistency correction through a refiner. After refiner the broke stream is led to Blending chest through a magnetic flow transmitter and a control valve. The consistency of broke is measured and controlled in the similar manner as explained earlier. Recently in line consistency sensing method has been developed where no rotating element is needed but a blade configured in such a way that it eleminates the effect of velocity impact and measures only the frictional force of the stock flow. This transmitter operates on force-balance principle.

The Blending chest controls are engineered in such a way that it continuously proportion in a set ratios the primary refined stock flow, Broke flow, flow of dyes and additives etc.

The furnish control system provides for appreciable flexibility in proportioning of each component. Each can be set to a choice of wide range to be admitted in the Blending chest.

The stock, size, Alum, loading (clay), Dyes etc. are set on percentage ratios of total Blended furnish by means of pneumatic percentage setting regulators.

The Blending chest or mixing chest whatever it is called, is equipped with the master level Transmitter and the transmitted signal fed to a master controller.

Supposing for example, the chest level has gone down, perhaps due to speeding up of paper machine, the level inside the mixing chest has a tendency to fall below the set point. Immediately the master level controller will send corresponding corrected output signal to all flow ratio Recording controllers of stock and aditives to adjust for increased flow with the ratioed proportion to bring up the desired level in the Mixing chest. Hence, the furnish remains uniform and operatives has nothing to worry about enhanced draw by paper machine. The similar control action holds good while machine speed is reduced or less draw due to some reason or other.

The magnetic flow meters, touched earlier, measure the flows of all components. This device of flow measurement is by far the best for accurate and dependable measurement. The salient features of its design incorporates no restriction inside measuring tube and is based on Faraday's law of electromagnetic induction. The flowing fluid must be a conductor of electricity and properties of conductivity does not limit the design of the magnetic flow meter.

The stock from the Blending chest is pumped to Machine chest through a consistency Recording controller. Thus the furnish reaches the machine chest with a controller consistency.

The machine chest level, is controlled by a level Recording controller. It controls in the similar way as has been explained for Refined stock chest.

The stock from machine chest is forwarded to paper machine after routing through machine refiner. The entire instrumentation helps to have precise control and regulation of varying demand in quantity and quality as well.

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