FACTS and COMMENT relative to CROSS*FLOW SIEVES.

A sieve in this reference is a method of screening, different in function and application than usually considered for normal screens or screening. A sieve has a bar or profile bar screen surface that are at right angles to the direction in which the slurry mixture streams across the sieve. A mixture of particles and liquid (slurry) is introduced into a weir box and streams via a vertical funnel or leveling device over the whole width of the sieve tangentially, that has been installed at a pitch of 55-60°.

The sieve functions by a layer of slurry moving over the profile screen surface, with a thickness of slurry moving thru the slot approximately ½ the slot opening. An example: A 1mm opening is crossed by the slurry, about ½mm slurry thickness moves thru the opening. This thin layer (½mm thickness) is about what hits the side of the profile wire and is forced through the opening. This thin layer will carry through particles one-half the opening or less (or minus ½mm solids). This condition tends to continue (contrary to straight line deflection theory) most likely caused by the Coanda effect when contact with the profile takes place, the underside of the liquid stream flowing over the sieve is retarded, such is not the case when an opening has to be crossed, permiting this small downward deflection of the slurry stream.

From the foregoing it can be concluded that the thickness of the layers spouting thru the opening or the fineness of the separation is not affected primarily by the forces of gravity or whether the sieve surface is curved or flat. For any sieve to function properly, it is essential that the liquid layer (slurry) stay in contact with the sieve surface. A curved surface is a means to accomplish this contact, a flat sieve requires more attention to feed condition of the slurry and thereby usually has the larger capacity and sharper separation of the solids. Centrifugal force is only of secondary importance in the operation of a sieve, andspecific gravity of the particles is of no influence on the fineness of particle separation.

It can be calculated that the force of gravity in the case of the sieve has no influence of importance on the thickness of the layer spouting thru the slots or of the fineness of screening, whenthe velocity with which the liquid slurry streams over the sieve surface does not drop below about 10 feet-per-second. In fact, the flat sieve does not vary the fineness and per example would not pass any plus ½mm product, however a curved sieve is slightly affected by gravity to the extent that .61mm product could pass the lower quadrant of the segment.

Wear caused by any abrasive solids will lower the efficiency of the sieve by reducing the thickness of slurry contacting the side of profile bar. Reversing the sieve surface will restore efficiency until again it becomes necessary to repeat this proceedure. Therefor, it is imperative where abrasion can be anticipated, design consideration must provide a a means to simplify these proceedures.

The capacity of a sieve is great, due to the velocity with which the thin layers spout thru the slots. This velocity is of the same order of magnitude as the feed velocity. The following charts for sizing and capacities are based upon data developed under tests and calculations. They can be used with complete confidence in all general applications adaptable to the sieve.

Calculations using aforementioned data for 1mm opening - 1 slot on every .135" face of sieve (in direction of flow) a feed of 1.2" thickness would be consumed after $\frac{1.20}{.010}$ x .135" = 16.2" face of screen surface in direction of slurry flow is indicated. In practice we find that this face surface must be 30 inches, before the feed layer of 1.20 inches is consumed. With this fact in mind it is evident that the velocity of the feed does not influence the sieve surface required to consume the slurry thickness. The decrease in thickness of the layer after passing a slot is namely in priciple independent of the velocity this layer is introduced to the sieve. Thus, it is expected that the capacity of a sieve is proportional to the feed velocity and to the free area of the sieve. Our experience indicates this as about right, within certain limits, and a general formula can be used to estimate sieve capacity. $C = \frac{A\ V}{0.5}$ In this formula:

C = capacity per foot (30" standard depth) in GPM.
A = free area of the sieve in square inches.
V = velocity in feet per second * Use 10 ft/sec.

* The minimum velocity required is dependent on the width of the slots and the viscosity of the feed suspension. From the above we conclude that the most important elements to be considered are: (1) the slurry must stay in contact with the sieve surface, and; (2) the consist of the slurry to be approximately 20% or less free draing solids for a desireable application.

Desired Separation	8 M .093"	10 M .066"	1mm .040"	28 M .023"	½mm .020"	35 M .016"	¼mm .010"	100 M .006"
Sieve Openings	.185"	.130"	.080"	.045"	.040"	.031"	.020"	.012"
"CAPACITY per foot, indirection of slots - standard 30" surface - GPM.								
Profile -								
DOA - 100	390	355	285	210	190	165	115	70
DOA - 132	360	320	250	180	* 165	140	110	60
DOA - 156	315	270	210	145	130	110	70	35

In the discussion for the general application above, we assumed the solids consist to be free draining and the partical size distribution fairly uniform, to the extent that the liquid adhering to particle would be of small order for determination of efficiency.

Where velocities in excess of 10 ft/sec to 12 ft/sec are indicated, it is doubtful that a weir type of feed would be practical. Utilization of pressure boxes and other devices are required. We have not employed any of these devices in conjunction with a flat sieve. Repulping of the screen overflow is very sucessful when handling slurries with higher viscosities, if they are free draing. Consideration should be given to the use of our HYDRO-KLEEN SIEVER under these conditions. More information and performance data in this device will be available very soon.

All sieve failures we have investigated to date have been due to:

(1) Failure to keep the slurry in contact with the sieve surface - contact can be maintained of the profile bar is flat topped and feed is uniform and tangent to the sieve surface.

(2) Inadequate feed velocity, due to slurry viscosity - this factor is the most difficult to determine from the data usually available to us.

The trial and error system has prevailed pretty much in these applications, and about all we know is that the sieve works or doesn't work. From the above facts we must recognize that a definate limitation does exist for the application of a weir fed flat sieve. We do expect to run a series of tests so that it will be possible to establish those conditions that can limit application of this device.

Wedge Wire Corporation

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