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METHOD OF MAKING A FINE SCREEN

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A method of making a fine screen consists of jabronically welding or otherwise fastening individual wedge-shaped bars to support members or ribs.

The ability of screens of the aforesaid type to differentiate between particles of different sizes in a uniform manner depends on the uniformity of slot width. This characteristic becomes increasingly more important as the slot width is decreased. Because of the inherent difficulty of jigging a wedge-sectioned rod or wire in fabrication, variation in slot width is inevitable and increases percentage wise as the slot opening is decreased. As a result, sharpness of separation decreases as variation in slot opening increases.

According to the present invention inobvious improvements in a fine screen of the aforesaid "stationary" type are realized by forming the screening deck thereof of a moldable synthetic organic material, which term I employ herein as including synthetic organic elastomeric materials and plastics. The mode of fabricating the screening deck is that of molding from a liquid as by liquid casting, pressure forming, injection casting or by like procedure, or by suitably calendering a material in readily impressionable—"intermediate"—state.

Amongst elastomeric materials for use in forming the fine screen of the present invention are the following: neoprene, butyl rubber, butadiene-styrene rubber and urethane rubbers; fluorocarbons; silicones. Amongst plastics for this use are the following: various resinous compounds such as nylon, polystyrene, polyethers, alkyd resins, melamine resins, phenolic resins.

The fine screen panel of the present invention consists essentially of a unitary "slab" or body having on one side thereof a plane screening surface, said slab comprising an array of interconnecting screening bars and support bars. The spaced screening bars are parallel to each other, and the spaced support bars—parallel to each other—preferably are disposed at an angle of less than 90° to said screening bars. Each of said screening bars and support bars has, in cross-section, the shape of a truncated pyramid or wedge, the bases of the pyramids lying in a single plane and providing the aforesaid screening surface.

The invention will now be described in greater particularity and with reference to the appended drawings, in which

FIG. 1 is a perspective view of apparatus for carrying out the process of the present invention;
FIG. 2 is a perspective view of a fragment of a screening deck (hereinafter referred to as a "panel") embodying features of the present invention; and
FIG. 3 is a side elevational view of the fragment shown in FIG. 1, in section.

THE MOLD

The mold "M" was composed of a lower plate (or, "mold cavity") 11 and cooperating upper plate 12. Lower plate 11 was a piece of free-machining steel 1.25 inches in thickness by 16.0 inches square. The steel piece was machined top and bottom to flat parallel surfaces. On the top side of lower plate 11 a first series of 72 similar parallel grooves 15 were machined in the surface, the grooves being 0.15 inch in depth and spaced apart so as to leave an uncut portion of the surface, between each two adjacent grooves, 0.07 inch in width. At the top the grooves were 0.09 inch in width. These dimensions provide a positive draft angle of 8.5°.

At a 45° angle to the grooves of said first series there were cut into the piece a second series of 56 parallel grooves 20 of the same cross-section as were the grooves of said first series, the spacing between adjacent grooves...
of said second series being 0.354 inch. Thus, the interconnecting first and second series of grooves 15 and 20 form separate truncated peaks therebetween which are formed so that the tops thereof lie in a plane slightly above the plane of the periphery of the molded plate 11, i.e., of the order of magnitude of .001". A third series of 4 grooves 25, having a depth of 0.2 inch and a width of 0.2 inch, were cut around the periphery of the grooved portion of the plate to define a 12 inch square.

The above-described second series of grooves and the third series of grooves were in a form complementary to a symmetrical truncated pyramid their sides having the same angle of inclination.

In the four corners of plate 11, bolt holes 26 having a diameter of ½ inch were drilled.

Upper plate ("cover") 12 was a piece of steel 16 inches square and 1.25 inches thick, machined to have flat parallel upper and lower surfaces. Bolt holes 27 matching holes 26 were drilled in plate 12.

In addition to the above-described components of the mold, there was provided a sheet 27 of "Teflon" (tetrafluoroethylene), having a thickness of one thirty-second of an inch, which "Teflon" sheet was of a size just covering the aforesaid 12-inch square but having at each of its four corners an "ear" projection 30 having therein an aperture 31 matching bolt holes 26 and 27.

Bolts 34 were provided for securing together the mold cavity 11, Teflon sheet 28, and upper plate 11, i.e., of the order of magnitude of .001". This protrusion resulted in the production of screen castings with flash-free parallelogram-shaped openings.

THE MOLDING MIXTURE

In this specific example the starting material was a room temperature-curing urethane ("Flexane 85, liquid") consisting of an isocyanate resin in liquid form and a liquid hardening agent. The two liquid components were mixed together at room temperature and thereupon were ready for use.

THE CASTING PROCEDURE

The surfaces of the mold cavity were sprayed with a liquid mold release compound, to prevent the elastomer from sticking, and was allowed to dry.

Thereupon, the aforesaid two-part urethane rubber mixture was poured into the mold cavity and spread so that there was an excess of the mixture over that amount required to completely fill the interconnecting grooves. The "Teflon" sheet 28 was then positioned over the filled mold cavity 11, the upper plate (i.e., "cover") 12 was placed on top of the "Teflon" sheet, and the three parts were bolted together by means of bolts 34. The excess resinous material is thus removed from the tops of the truncated peaks to eliminate substantially all flash adjacent the peaks, as previously mentioned and the excess resinous material will be destriped at the edges of the metal mold.

The liquid urethane mixture "set" in approximately one hour, and hardened over night to the point where "demolding" was feasible. The so-produced screen panel 35 was easily stripped from the open mold.

The completed panel was a square slab 12 inches on a side, and comprised 72 parallel wedge-shaped screening bars 37, supported by 32 diagonally disposed supporting bars 39 and by a somewhat larger dimensioned peripheral supporting rib 40.

A stationary fine screening deck was fabricated by fixing the above-described screening panel to a support characterized by an array of parallel arcuate metal support rods, spaced apart on two inch centers, and joined at top and bottom by a number of diagonal metal beams. The same was then associated with conventional adjustable means for positioning the curved screening deck at a suitable angle for use in screening an aqueous slurry or "pulp" of finely divided solid oxide ore particles of various sizes.

Supported by 32 diagonally disposed supporting bars 39 and by a somewhat larger dimensioned peripheral supporting rib 40. The above-described screening deck was used in classifying an aqueous slurry of finely subdivided particles of iron oxide ore material varying in sizes between 100 mesh and 10 microns. A sharp split was realized.

Molded or cast screens of the sort above described have an advantage over welded metal screens in that the cant or attitude of the wedge-shaped bar can be more accurately controlled. The top surface of each wedge-shaped screening bar should be parallel to the screening surface so that the screen panel can be reversed with respect to the direction of slurry flow.

A screen panel embodying principles of this invention can be constructed such that in its use a controlled amount of screening bar flutter or movement will result which movement minimizes the tendency for the slots to become blinded or plugged. The flutter or movement of the bars can be controlled by selecting the appropriate stiffness of the wedge section, the distance between the supports or ribs, and the method for inducing flutter. The flutter may be induced by slurry flow, by sound waves, by machine vibration, or by mechanical shock.

A screen panel made in accordance with this invention can be used as a flat screening surface or as a curved screening surface merely by substitution of spaced metal supports and selection of the curvature of the wedge section. Furthermore, by the use of semi-flexible support rods, the curvature of the screen can be varied from straight to any desired curvature while the screen is in operation. This feature allows an additional means of performance control a slurry characteristics change.

Another unique feature of a screen panel made under this invention utilizing elastomers consists in the fact that the panel can be made so that the width of the screen opening is variable. The variation is obtained by stretching the panel in a direction parallel to the screening slots. In this manner, the width of the slots is controllably adjustable.

In the manufacture of stationary fine screens heretofore the parallel-wedge-shaped bars were fastened to the support bars by welding each individual joint which resulted in an extremely high fabrication cost. An outstandingly unique feature of the present method resides in the fact that as the simple casting is made all of the intersections (of screening bars with support bars) are formed simultaneously and automatically. The forming of the joints is made possible by making a draft angle on the support bars so that the cross section of the support bars is the same as that of the wedge-shaped screening bars.

The removal of the casting from the mold is facilitated by the fact that the screening bars and the support ribs are in the same plane and all interconnecting members have a positive draft. In the traditional method of fabricating fine stationary screens the screening bars were welded on top of the support bars, and hence the two sets of bars lay in different planes. The mold grooves have been cut with care, the screening bars were unvarying in straightness and in cross-sectional dimensions, and their spacing was exact. The individual panels were repeatedly duplicated (in the same mold) with no variation in any measurement. The exactness of these dimensions and of this spacing and the uniformity of panels make it not burdensome and open to advantage to produce thus-molded screens for industrial application. The cost of manufacturing the screening panels was very significantly less than was the cost of manufacturing a similar metal screening panel.
The chief advantage of the cast elastomeric screens of the present invention is that they are made of a material that outwears steel (traditional material for this type of screen) by a factor of 10–100 times, and outwears natural rubber by a factor of 2–5 times.

The efficiency with which fine stationary screens operate depends largely on the sharpness of screening openings. By the present method an extremely sharp screening opening is produced as the metal parallelogram-shaped openings on the surface of the mold protrude up into the Teflon. Furthermore, as Teflon has “memory” and returns to normal shape when the pressure is removed, it is usable over and over again.

It is to be appreciated that the data of the above specific example are not limiting of the scope of the present invention. Thus, the screening panels have been cast using Du Pont’s “Adiprene,” Thiokol’s “Solithane” and Devcon’s “Flexane,” all of which are urethane liquid elastomers. This description is not intended to be restrictive to the materials just enumerated, since other plastics and elastomers could be used as well.

Nor are the specific angles between screening bars and support bars critical. While the invention has been illustrated through disposing first and second series of bars at approximately 45° to each other, it is a fact that any angle between about 90° and about 10° will be found to be operable, depending upon the particular slurry involved and other variables.

Moreover, the particular widths of the screening bars and the particular sizes of the screen openings or slots are matters of engineering and experience.

Production of the screens may be accomplished by pressure forming, liquid casting, and injecting casting. With increased draft angle on the mold and the mold actually on a roller, the screen material can be manufactured in continuous rolls (i.e., by “continuous casting” techniques).

I claim:

1. A method of making a synthetic organic resinous screening panel which comprises introducing a liquid hardenable synthetic organic resinous material into the cavity of a metallic mold having a network of interconnecting grooves which form a plurality of separate truncated peaks, the tops of which lie in a plane slightly above the plane of the periphery of the metallic mold, in an amount in excess of that required to completely fill the interconnecting grooves, placing a resilient covering sheet over the filled mold, placing a rigid plane cover over the resilient sheet securing the cover and sheet to the metallic mold thus compressing the tops of the truncated peaks into the resilient sheet whereby the excess resinous material will be removed from the tops of the truncated peaks to eliminate substantially all flash adjacent the peaks and the excess resinous material will be exuded around the edges of the metallic mold, allowing the resinous material to set and harden, removing the rigid cover and resilient sheet from the mold and finally removing the synthetic organic resinous screening panel from the mold.

2. A method as claimed in claim 1 wherein the liquid resinous material is composed essentially of a room temperature-curing isocyanate resin in liquid form and a liquid hardening agent therefor.

3. A method as claimed in claim 1 wherein the resilient covering sheet is composed of Teflon.

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