SAND SIEVING APPARATUS

TECHNICAL FIELD

[001] This invention relates to an apparatus for sieving granular aggregate such as sand to obtain uniform aggregate size of the sieved material according to mesh size of the sieve. It is particularly directed to such apparatuses comprising a sieve tray mounted on a chassis for open pouring and sieving of aggregate, and is more particularly concern suspension-mounted sieve trays.

BACKGROUND ART

[002] Conventional sand sieve comprises a sieve tray mounted on a chassis and which are normally fabricated from cast iron to withstand rough use and heavy throughput at construction or quarrying sites. This sturdiness is required to prevent flexure or warping which might lead to metal fatigue in time. Unfortunately, such robustness renders the sieving apparatus heavy, expensive and difficult to fabricate. The sieve tray is typically constructed of a strong gauge wire mesh, or metal sheet having perforations of the required pore size, laid over a metal frame reinforced with cross bars.

[003] To improve sieving and absorb impact of aggregate being poured thereunto, a number of features have been incorporated into conventional sieves. One is to provide some form of suspension to the sieve tray mounted on the chassis by providing coil spring mountings which would absorb and translate the impact of the aggregate loadings into limited vertical oscillations. Such vibratory movements of the sieve tray also aids in clearing particles through the mesh and increase throughput. Unfortunately, however, such vertical oscillations would also amplify the rebounce of the aggregates on the mesh leading to increase in spill overs.

[004] To provide sustained vibration, vibration generators are introduced. These may be electromagnetic motors, eccentric motors, electromagnets and like devices attached to one part of the sieve tray such that the vibration is transmitted throughout the tray in a sustained manner as the aggregate is poured over the sieve tray.

[005] Under damp or wet conditions, the aggregate tends to agglomerate or agglutinate to form clumps or lumpy masses which would slow down the sieving process while awaiting the vibration to break up the clumps into sievable particle size and leaving larger ones run off the sieve tray. To prevent clogging and overloading of the sieve, a hopper is usually provided to control and direct the flow of aggregate onto the sieve tray.

SUMMARY OF DISCLOSURE

[006] We try to mitigate some of the above problems and disadvantages by providing a construction of an apparatus that is much lighter by using less amount of metal and choosing to reinforce only those parts necessary to withstand the rigours of pouring and sifting.

[007] Another aspect which we endeavour to improve upon include providing for a more vigorous and directional vibration that could be translated into minimum vertical and maximum horizontal shaking of the sieve tray by a unique suspension so that the aforementioned agglutination problem is quickly solved to give a more efficient sieving and sustained throughput. This solution enables us to dispense with the need for a hopper or controlled pouring of aggregate.

[008] In fact, we have found our sieving throughput to be so effective that our sieving tray are able to take an open and direct unloading from a loader bucket.

We have accordingly built our sieving apparatus's dimensions to cater for such direct and open bucket unloading of raw aggregate and loading of sieved sand.

[009] Briefly, the general embodiment of our sieving apparatus may be broadly described as comprising a chassis, whereupon a sieve tray may be removably mounted at an inclination for open pouring thereunto of aggregate to be sieved. Suspension means may be provided as sieve tray mountings on said chassis whereby the suspension means allows both vertical and horizontal oscillations of said sieve tray. A vibration generator may further be provided in operative contact with the sieve tray. Preferably, the mountings are configured or arranged to minimize vertical oscillations and maximise horizontal oscillations of the sieve tray due to vibration generated by the vibration generator.

[010] In a first aspect of our invention, the chassis includes a pair of uneven parallel first and second bars wherein the first bar is higher than the second bar upon which the sieve tray's upper edge and lower edge may rest respectively. The first and second bars may each be reinforced with beams, preferably I-shape steel beams welded onto said first and second bars.

[011] In a second aspect, our apparatus's sieve tray may be provided with a plurality of legs adapted to be securely received on the chassis, including onto the reinforcing beams. As a preferred embodiment, the sieve tray mountings may be provided with sockets into which corresponding legs of the sieve tray may be removably inserted. The sieve tray mountings may comprise of a coil spring bracketed between a pair of plates, i.e. an upper plate and a lower plate. The upper plate may be in operative contact with a leg of the sieve tray while lower plate in contact with the chassis bar or reinforcing beams.

[012] Preferably, the sieve tray mounting is adapted to receive a leg of the sieve tray coaxially into the coil spring, and the upper plate is adapted with a socket to receive a leg of the sieve tray.

[013] In a third aspect, at least a vibration generator is provided in operative contact with the sieve tray at the upper side of the tray frame. Preferably, two or more vibration generators are provided. A vibration generator may each be disposed to impart vertical oscillation and horizontal oscillation to the sieve tray.

[014] In a fourth aspect, the length of the sieve tray may sufficiently spans the width of a loader bucket approaching the lower side of the sieve tray and pouring aggregate onto said sieve tray. Preferably, the chassis is configured with sufficient length to accommodate the width of a loader bucket approaching the higher side of the sieve tray and placing said bucket underneath said sieve tray to catch the sieved aggregate falling through said sieve tray. The chassis structure is preferably formed with hollow steel bars of sufficient thickness, say about 7mm thickness, to ensure durability and resistance to accidental contact with excavators and bulldozers.

LIST OF ACCOMPANYING DRAWINGS

[015] For ease of understanding of our apparatus, we would now refer to the following drawing(s) accompanying this specification in our detailed description that follows as non-limiting and exemplary illustration of specific or preferred embodiments of our invention, in which:

[016] FIGURE 1 shows a perspective view of our sand-sieving apparatus.

DETAILED DESCRIPTION OF SPECIFIC OR PREFERRED EMBODIMENTS

[017] As illustrated in FIG. 1, the general embodiment of our sand-sieving apparatus comprises of 2 main components, namely a chassis (10), upon which a sieve tray (20) may be securely mounted in a removable manner so that sieve trays of different mesh size may be substituted as desired. The sieve tray (20)

is mounted on the chassis (10) at an inclination suitable for open pouring thereunto of mixed aggregate from a container such as that of a loader bucket. Two aspects of this basic configuration of a sieve tray mounted on a chassis are providing suspension means and vibration to the sieve tray, and which are to be further described in detail in the following.

[018] The chassis (10) is constructed from elongate elements comprising steel bars or tubes welded together to form a framework. Rather than the conventional cast iron, our use of bars and tubes results in considerable savings in materials (and thus cost) and weight. For example, in our prototype, we used mild steel (MS) tubes or pipes of 75 mm diameter cut into the desired length forming the member elements of the chassis and welded them together.

[019] We chose to reinforce those parts of the chassis (10) most susceptible to rigours and impact of the aggregate pouring and sieving process. The chassis structure is preferably formed with hollow steel bars of thickness of sufficient strength, such as 7mm thickness to ensure durability and resistance to accidental contact with excavators and bulldozers. This is invariably the two horizontal bars (14, 16) upon which the sieving tray (20) rests, and which are usually disposed as uneven parallel bars of the chassis so that the proximal (with reference to the approaching loader bucket to unload onto the sieve tray) bar (14) lower than the distal bar (16).

[020] As seen in FIG. 1, each of the proximal and distal bars (14, 16) are reinforced with I-beams (16, 18), by welding them to the bars (12, 14) of the chassis (10). In our prototype, I-shape steel beams of 150 $\times$ 150 mm dimensions have been used and tested successfully. With such reinforcement, our chassis (10) may be made with less material and hence lighter but still capable of withstanding the rigours of site use.

[021] Another feature of our sand sieving apparatus for mitigating the rigours of pouring and sieving of aggregate at site is the provision of suspension means

at the points where the sieve tray (20) is mounted onto the chassis (10). This may be, for example, a plurality of legs (30a, 30b, 30c, 30d) to be inserted into corresponding sockets on the chassis parts, including on the corresponding parts of the reinforcing beams (16, 18) to facilitate ease of mounting and removing of the sieve tray (10). Our suspension means allows the sieve tray to oscillate in both vertical and horizontal directions. To this end, we provide suspension means in various configurations or embodiments.

[022] In one embodiment, each of the sieve tray mountings (30a, 30b, 30c, 30d) comprises a coil spring placed in compressible disposition between a pair of brackets in form of steel plates in a vertical orientation. This puts the upper plate in operative contact with a leg of the sieve tray while the lower plate would be in operative contact with the chassis bar (14) or reinforcing beams (16) with the coil spring affixed in between the 2 steel plates. Preferably, four of such suspension means are provided at each corners of the sieve tray (20).

[023] In a preferred embodiment, the upper plate may be adapted with a socket shoe to receive the foot end of a leg of the sieve tray. Alternatively, the socket may be provided in the form of an aperture through the upper plate wherein the leg may be inserted coaxially into the coil spring.

[024] In another preferred embodiment, the suspension means may be provided in the form of rubber mounts of industrial grade such as the YM type (YM-2000 series, e.g. YM-2040) of rubber mounts provided with a neoprene base plate which are found to be effective in reducing vibrations to low natural oscillations. The YM type of rubber mounts are available from Youil Ensys Corporation of Hwasung City, Korea (see http://www.youil.com/eyouil /noise06_01.asp?Tcode=Noise&TNo=6&GName=G_YM).

[025] Another aspect of our invention concerns providing vibration to sieve tray. At least a vibration generator may be provided in operative contact with the sieve tray (20) at the upper side of the tray frame. Preferably, however, at

least two vibration generators (35, 36) are provided. The vibration generator may be arranged or disposed in such a way so that each separately imparts vertical and horizontal oscillation to the sieve tray. The choice of vibration generators may be made from any one or combination of a motor, eccentric motor, electromagnet, hydraulic pumps, and like devices.

[026] In contrast with the motors used for conventional sieving apparatus which run at about 1000 rpm, we use at least 2 vibration generators (35, 36) which can produce 3000 rpm each. Both vibration generators are placed side by side and are disposed to impart vibration to the sieve tray (20) at the upper side of the tray frame. A preferred vibration generator used in our prototypes is an electric vibrator for industrial use of the MVSI-type, in particular, the MVSI 3/500-S90 model which is a 2-pole vibrator capable of delivering 3000/3600 rpm available from Italvibras G. Silingardi SpA, 41049 Sassuolo MO - Via Puglia, 2/4, Italy.

[027] In combination with our unique suspension means described above wherein the sieve tray (20) is capable of both vertical and horizontal oscillations, a “slicing-and-sieving” effect resulting from a rapid but limited shaking and panning action of the sieve tray is provided whereupon clumpy masses of aggregate may quickly be broken down, sieve through and the larger particles and other debris may quickly be removed as run offs sliding down the top of the sieve. Due to the synchronised oscillation direction and same directional centrifugal force of both attached motors, the slicing motion is amplified. This results in a significant improvement in sieving throughput.

[028] Without a hopper placed over the sieve tray, it would be much more convenient to change the tray to a different mesh size. For example, sieve sizes of 20 mm, 10 mm and 5 mm are commonly used to obtain sand of the desired size for a chosen texture of cementitious mixture.

[029] This allows for the direct and open unloading of aggregate from a loader bucket without the use of a hopper for directed and controlling the rate of flow of the aggregate. Accordingly, we have designed our sand-sieving apparatus's dimensions to take advantage of this open unloading by providing for the length of the sieve tray to sufficiently spans the width of a loader bucket approaching the lower side of the sieve tray and pouring aggregate onto said sieve tray. As an example, for a Caterpillar loader model 966 series, we have made our sieve tray length to about 3 metres. The width of the sieve tray may be provided at about 2 metres depending on the inclination of the tray.

[030] The chassis (10) may also be configured to sufficient length to accommodate the width of a loader bucket approaching from the distal or higher side of the sieve tray and placing the bucket underneath the sieve tray to catch the sieved sand falling through the mesh. For good clearance by the bucket, the length of the chassis may be provided at about 4 metres, i.e. about 0.5 m clearance on either side. Alternatively, the part of the chassis at the underside of the sieve tray may be adapted for other means of collecting the sieved sand such as a conveyor belt system.

[031] Many of the components described herein may be modified, altered, varied or substituted with alternative or equivalent structures or parts that we have not specifically described here. They are thus not to be considered as departures from our invention but as falling within the scope and spirit of our claims that follows.

CLAIMS

We claim:

1. A sand-sieving apparatus comprising:

- a chassis (10), whereupon
- a sieve tray (20) is removably mounted at an inclination for open pouring thereunto of aggregate to be sieved;
- suspension means provided as sieve tray mountings (30a, 30b, 30c, 30d) on said chassis (10), said suspension means allows both vertical and horizontal oscillations of said sieve tray; and
- at least a vibration generator (35, 36) in operative contact with said sieve tray (20).

2. A sand-sieving apparatus according to Claim 1 wherein the suspension means comprises said mountings configured or arranged to minimize vertical oscillations and maximise horizontal oscillations of the sieve tray (20) due to vibration generated by said vibration generator.(35, 36).

3. A sand-sieving apparatus according to Claim 1 wherein the chassis includes a pair of uneven parallel first and second bars (12, 14), wherein the first bar is higher than the second bar upon which the sieve tray's upper edge and lower edge rest respectively.

4. A sand-sieving apparatus according to Claim 3 wherein said first and second bars (12, 14) are each reinforced with beams.

5. A sand-sieving apparatus according to Claim 4 wherein the beams comprises I-shape steel beams (16, 18) welded onto said first and second bars (12, 14).

6. A sand-sieving apparatus according to Claim 1 wherein the sieve tray (20) is provided with a plurality of legs (30a, 30b, 30c, 30d) adapted to be securely received on said chassis (10), including onto the reinforcing beams (16, 18).

7. A sand-sieving apparatus according to Claim 6 wherein the sieve tray mountings (30a, 30b, 30c, 30d) comprise sockets into which corresponding legs of the sieve tray (20) are removably inserted.

8. A sand-sieving apparatus according to Claim 7 wherein each of the sieve tray mountings (30a, 30b, 30c, 30d) comprises a coil spring bracketed between a pair of plates comprising an upper plate and a lower plate respectively in operative contact with a leg of the sieve tray and the chassis bar or reinforcing beams.

9. A sand-sieving apparatus according to Claim 8 wherein the sieve tray mounting is adapted to receive a leg of the sieve tray coaxially into the coil spring.

10. A sand-sieving apparatus according to Claim 8 wherein the upper plate is adapted with a socket to receive a leg of the sieve tray.

11. A sand-sieving apparatus according to Claim 1 wherein at least a vibration generator is provided in operative contact with the sieve tray (20) at the upper side of the tray frame.

12. A sand-sieving apparatus according to Claim 11 wherein at least two vibration generators are provided.

13. A sand-sieving apparatus according to Claim 12 wherein a vibration generator is each disposed to impart vertical oscillation and horizontal oscillation to the sieve tray.

14. A sand-sieving apparatus according to any one of Claims 11 –13 wherein the vibration generator is selected from a motor, eccentric motor, electromagnet and the like.

15. A sand-sieving apparatus according to Claim 1 wherein the length of the sieve tray sufficiently spans the width of a loader bucket approaching the lower side of the sieve tray and pouring aggregate onto said sieve tray.

16. A sand-sieving apparatus according to Claim 1 wherein the chassis is configured with sufficient length to accommodate the width of a loader bucket approaching the higher side of the sieve tray and placing said bucket underneath said sieve tray to catch the sieved aggregate falling through said sieve tray.

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