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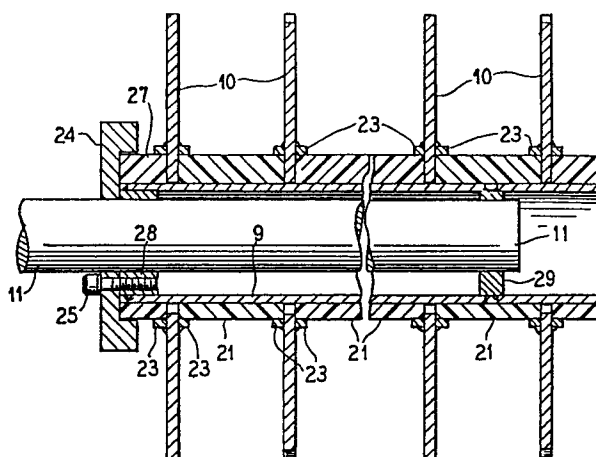
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Prevention of wedged jamming in disk screens.

A disk screen especially adapted for scalping hog fuel and the like has the interdigitated disks (10) of the screening bed mounted on their shafts (9) in a manner to permit adjacent interdigitated disks (19) to deflect relatively when a migrant particle tends to engage wedgingly between the interdigitated disks (10) so that the migrant particle will be prevented from jamming the engaged disks (10) but will be cleared therefrom automatically in the continuing rotation of the disks (10). Resiliently yieldable elastomeric spacers (21) maintain the disks (10) in predetermined spaced relation to permit the relative deflection of the disks (10).



This invention relates, in general, to disk screens, and is more particularly concerned with solving a problem encountered in certain uses of such screens wherein there is a liability of particles jamming when not large enough to be scalped from the material being screened and not quite small enough to pass through the screen.

The problem which the present invention is intended to solve has been encountered in scalping disk screens which are adapted to handle so-called hog fuel and waste products remaining as byproducts from supplying of pulp wood to the paper making industry. Those parts of the pulp wood source material, that is of the trees, which cannot be used for paper making wood pulp, such as unduly knot-infested tree parts, branches and bark may be used for fueling boilers. For such use, it is desirable to screen out incombustible or otherwise undesirable fractions of a hogged fuel or otherwise broken up supply of the wood fuel material. Scalping disk screens have been employed for this purpose, such as variously disclosed in U.S. Patents 4 037 723, 4 239 119 and 4 301 930, and which are characterized by having a screening bed provided with a series of corotating spaced parallel shafts each of which has a longitudinal series of concentric screen disks which interdigitate with the screen disks of the adjacent shafts. The spaces between the disks permit material of smaller size to pass downwardly through the rotating disk bed. Since the disks are all driven to corotate in a common direction from the infeed end of the screen bed to the outfeed or discharge end of the bed, the particles of material which are larger than the spaces between adjacent disks will be advanced on the bed to the outfeed end of the bed. In screening chips for paper pulp purposes it is desirable to remove any material over a certain dimension from the properly dimensioned chips which fall through the screen. For hog fuel purposes, also, the objective is generally to remove oversize and

add material such as slivers, trim ends, rocks, etc. The through flow, or as sometimes referred to underflow, of the disk bed of the screen, free from slivers, sticks, trim ends, rocks, and the like, is in most cases the desired hog fuel product. On the other hand, the through flow may represent the rejects and the overflow, or oversize material may be transferred to process or rechipping, hogging or fractionating, depending on the type of material and its end use.

Among the screenings which should be removed from the hog fuel mass, bits of rock and tramp metal may be present, and where these are of a size approximating the screening disk gaps but not quite small enough to pass through readily, there is often the tendency for such particles, which may be referred to as migrant particles, to become wedged between adjacent interdigitated disks of the screen bed and jam the same, causing stoppage of the screen, and often serious damage. The proclivity toward such jamming and damage in prior disk screens as represented for example, by the beforementioned U.S. patents will be apparent because the screen disks are rigidly held in axially spaced relation along their shafts. In addition, the disks themselves for the intended hog fuel screening uses are generally of a rugged, rigid, steel structure. Each disk may be about 9 mm thick and about 432 mm in overall diameter. There may be eleven disks spaced about 102-6 mm on each alternate shaft and twelve disks similarly spaced on the other shafts, with the disks of adjacent shafts interdigitated and the spacing between the interdigitated disks being about 25-5 mm. Any particles smaller than such interdigitated disk spacing will fall through as the material is advanced across the screening bed, and larger particles will be moved on. Some particles may be of such an intermediate size or irregular shape that there is a tendency to jam between interdigitated disks. For example, uneven particles such as rocks or tramp metal, or even some wood particles which may be partially smaller than the between the disk spaces and in

other respects slightly larger may tend to migrate wedgingly between and jam the disks.

It is to the alleviation of the problem just
5 described that the present invention is directed.

To this end the present invention provides
a disk screen apparatus comprising a screening bed having
a series of corotating spacedparallel elongate shafts each
of which has thereon a longitudinal series of concentric
10 screen disks which interdigitate in axially spaced relation
with companion screen disks on the adjacent shafts. The
screening bed is adapted to screen from particulate material
particles which are oversize relative to the axial screening
spaces between interdigitated disks, and resiliently yield-
15 able means are provided for normally maintaining the disks
in generally parallel screening relation to one another
on the shafts, such means permitting adjacent interdigitated
disks to deflect relatively when a migrant particle tends to
engage wedgingly between the interdigitated disks, so that
20 the migrant particle will be prevented from jamming the
engaged disks but will be cleared therefrom automatically
in the continuing rotation of the disks.

Other objects, features and advantages of the
invention will be readily apparent from the following
25 description of a representative embodiment thereof, taken
in conjunction with the accompanying drawings although
variations and modifications may be effected without
departing from the spirit and scope of the novel concepts
embodied in the disclosure and in which:

Fig. 1 is a fragmental side elevational schematic
30 illustration of a disk screen apparatus embodying the
present invention;

Fig. 2 is an enlarged fragmentary top plan
view of the screening bed of the apparatus ;

Fig. 3 is an enlarged fragmentary sectional
detail view taken substantially along the line III-III
35 in Fig.2; and

Fig. 4 is a fragmental sectional elevational

detail view taken substantially along the line IV-IV in Fig. 3.

As schematically shown in Fig. 1, a disk screen apparatus 5 of the kind with which the present invention is concerned comprises a frame 7 supporting a screening bed 8 having a series of corotating equally spaced parallel shafts 9 of generally similar coextensive length and each of which has thereon a longitudinal series of
10 equally spaced concentric screen disks 10 which interdigitate, as best seen in Fig. 2, with the screen disks of the adjacent shafts. To attain the proper disk interdigitation, there is a differential number of the disks 10 on the alternate shafts 9, such as eleven
15 disks alternating with twelve disks. In a typical arrangement of the disk screen apparatus 5, wherein the disks are of dimensions such as described hereinbefore, the screen bed 8 may comprise twelve of the shafts 9 carrying, in the aggregate, 138 of the disks 10. The
20 shafts 9 are preferably hollow tubular and of noncircular cross section (Figs. 3 and 4) and provided with respective stub shafts 11 at their opposite ends which are suitably journaled on the frame 7.

Means are provided, as is customary, for driving
25 the shafts 9 and thereby the disks 10 in unison in the same direction, clockwise as seen in Fig. 1, part of the drive means being identified at 13.

Material such as hog fuel to be screened is delivered to the infeed end of the screening bed 8 by
30 means of a chute 14. The arrangement may be such that desirable size particles of the material drop down through the screen bed 8 and are received in a hopper 15 for disposition while oversize and odd shaped particles are carried on the screening bed 8 toward the discharge end
35 of the bed. Those particles which are advanced by the screen bed 8 to its discharge end are discharged to an outfeed chute 17, as indicated by directional arrow.

For hog fuel screening the disks 10 are

preferably of round lobed, undulating perimeter having a uniform series of lobes 18 (Fig. 3) and mounting of the disks on the respective shafts 9 is desirably with the disks alternately torsionally offset along each shaft to have the lobes alternate substantially as seen in Fig. 3. Such alternation is provided for in the assembling of each set of disks on its shaft by having the shafts of substantially square cross-section and the disks provided with respective central apertures 19 which are of the generally complementary cross-section to the shafts and with clearance notches 20 aligned with the corners of the shaft perimeters. Thus, by properly formation of the shaft-receiving apertures 19 for the alternate disks of each set, when the set of disks is mounted on its shaft, the lobes will be in proper alternate relation to one another throughout the set.

Resiliently yieldable means are provided for normally maintaining the disks 10 in generally parallel screening relation to one another on their shafts 9, and such means permitting adjacent interdigitated disks in the screen bed 8 to deflect relatively when a migrant particle MP tends to engage wedgingly between interdigitated disks 10, so that the migrant particle MP will be prevented from jamming the engaged disks but will be cleared therefrom automatically in the continuing rotation of the disks in the screen bed. In a preferred arrangement, resiliently yieldable, generally annular spacers 21 are mounted on the shaft 9, in each instance, between each pair of adjacent disks 10 therealong for maintaining a substantially accurate longitudinally spaced relation between the disks. In a preferred construction, the spacers 21 comprise molded elastomeric members of a 70° Shore hardness, solid polyurethane being suitable for the purpose. The elastomer may, if preferred, be fabric reinforced similarly as conveyor belting to attain adequate stiffness and durability while still allowing sufficient resilient deformation for the present purpose.

In the preferred construction, the spacers 21 are

molded with respective central passthrough openings 22 which are complementary to closely fit the perimeter of the associated shaft 9 in corotatively keyed relation.

5 All of the spacers 21 are of equal length. On their outer perimeters, the spacers 21 may be cylindrical and of a diameter, at least at their ends, equal to the inside diameter of annular mounting shoulders provided by concentric annular rings 23 attached as by means of welding to the

10 respective opposite faces of each of the disks 10 adjacent to and about the central clearance holes 19 in the disks. By having the central openings 19 in the disks slightly oversize relative to the perimeter of the associated shaft 9, the shoulder rings 23 are adapted to support the

15 disks 10 in uniformly loosely spaced relation to the associated shaft. By their resilient stiffness, the spacers 21 will normally maintain the disks 10 in substantially accurate spaced parallel relation. However, when a migrant particle MP such as a rock or other tramp material such

20 as metal tends to wedge between adjacent interdigitated disks 10, the resilient spacers 21 are adapted to yield as the disks are deflected and permit the particle MP to be automatically cleared to move onward or pass through the screen in the continuing rotation of the disks in the screen

25 bed.

At the opposite ends of the shafts 9, the series of spacers is placed under endwise axial inward snug-up compression by means of retainer plates 24 received slidably about the outwardly projecting portions of the respective

30 stub shafts 11 and drawn up by means of bolts 25 against the outer ends of respective adaptor spacers 27 of similar construction as the spacers 21. Conveniently the bolts 25 are threaded into an associated outer filler or spacer plate 28 which may be welded to and project a short distance

35 outwardly from the adjacent end of the shaft 9 to serve as a stop to avoid overcompressing the series of spacers 21, 27 which are placed under endwise thrusting compression by the retainer plate 24 in each instance.

5 A stabilizer filler plate 29 may be secured as
by welding to the inside of the associated hollow shaft 9
and the inner end portion of the associated stub shaft 11
in each instance.

10 In a desirable relationship, the disks 10 may be
permitted by virtue of their resiliently yieldable mounting
and the clearance relation to the shafts in which the
inner perimeters of the disks are maintained by the
spacers 21, to have about 3 mm relative movement when an
article such as the particle MP tends to wedge between
any pair of interdigitated disks. It will be apparent
that in Fig. 2 the relative deflection has been somewhat
exaggerated for illustrative purposes. Any objects or
15 particles large enough to resist dropping down between
disks will be carried on the screen bed 8 to discharge,
while any objects or particles which are smaller
than would tend to wedge between the disks will automatic-
ally pass through the screen bed.

20 It will be understood that variations and modifica-
tions may be effected without departing from the spirit
and scope of the novel concepts of the present invention.

CLAIMS:

1. In a disk screen apparatus comprising a screening bed having a series of corotating spaced parallel
5 elongate shafts each of which has thereon a longitudinal series of concentric screen disks which interdigitate in axially spaced relation with companion screen disks on the adjacent shafts, said screening bed being adapted to screen from particulate material particles
10 which are oversize relative to the axial screening space between interdigitated disks:
resiliently yieldable means for normally maintaining said disks in generally parallel screening relation to one another on said shafts;
15 said means permitting adjacent interdigitated disks to deflect relatively when a migrant particle tends to engage wedgingly between the interdigitated disks, so that the migrant particle will be prevented from jamming the engaged disks but will be cleared therefrom
20 automatically in the continuing rotation of the disks.
2. Apparatus according to claim 1, wherein said means comprise spacers maintaining said disks in predetermined spaced relation along the respective shafts.
3. Apparatus according to claim 2, wherein said
25 shafts are of non-circular cross section, and said spacers comprise molded units having openings therethrough complementary to the cross section of the shafts.
4. Apparatus according to claim 3, wherein the spacers have cylindrical annular perimeters at least at
30 their opposite ends, and said disks have annular shoulders engaging said perimeters whereby the disks are maintained concentric relative to said spacers.
5. Apparatus according to claim 4, wherein the disks have central apertures loosely related to their
35 shafts.
6. Apparatus according to claim 1, wherein said resiliently yieldable means comprise elastomeric spacers.

7. Apparatus according to claim 6, wherein said elastomeric spacers comprise solid polyurethane having 70° Shore hardness.

5 8. Apparatus according to claim 1, wherein said disks are loosely mounted on their shafts, said means comprise resilient spacers maintaining predetermined spaced relation between said disks, and means for applying longitudinal snug-up pressure to the spacers along each shaft.

10 9. Shaft means for use in a disk screen apparatus wherein a screening bed has a series of corotative spaced parallel elongate shafts each of which has thereon a longitudinal series of concentric screen disks which interdigitate in axially spaced relation with companion
15 screen disks on the adjacent shafts, said screening bed being adapted to screen from particulate material particles which are oversize relative to the axial screening spaces between interdigitated disks, said shaft means comprising:

20 resiliently yieldable means for normally maintaining said disks in generally parallel screening relation to one another along a shaft perimeter;

said resiliently yieldable means permitting said disks to deflect relative to disks with which interdigitat-
25 ed in the screening bed when a migrant particle tends to engage wedgingly between interdigitated disks, so that the migrant particle will be prevented from jamming the engaged disks but will be cleared therefrom automatically in the continuing rotation of the disks.

30 10. Shaft means according to claim 9, wherein said resiliently yieldable means comprise spacers maintaining said disks in predetermined spaced relation along the respective shaft perimeter.

11. Shaft means according to claim 10, wherein said
35 shaft perimeter is of non-circular cross section, and said spacers comprising molded units having openings therethrough complementary to said cross section.

12. Shaft means according to claim 11, wherein the spacers have cylindrical annular perimeters at least at their

opposite ends, and said disks have annular shoulders engaging said spacer perimeters whereby the disks are maintained concentric relative to said spacers.

5 13. Shaft means according to claim 12, wherein the disks have central apertures loosely related to the shaft perimeter.

14. Shaft means according to claim 9, wherein said resiliently yieldable means comprise elastomeric spacers.

10 15. Shaft means according to claim 14, wherein said elastomeric spacers comprise solid polyurethane having 70° Shore hardness.

16. Shaft means according to claim 9, wherein said disks are loosely mounted on their shaft perimeter, said
15 resiliently yieldable means comprising spacers maintaining predetermined spaced relation between said disks, and means applying longitudinal snug-up pressure to the spacers.

17. An elongate shaft assembly adapted for use in a disk screen apparatus wherein a screening bed has a series
20 of such shaft assemblies corotatable to advance material along the bed from one end to the other end, said shaft assembly having :

a shaft with a longitudinal series of concentric screen disks loosely mounted thereon and which disks are
25 adapted for cooperating in interdigitated screening relation with the similar disks on adjacent shafts in the screening bed;

resiliently yieldable combination spacer and mounting means for engaging said disks and maintaining
30 them in predetermined spaced relation to one another and to said shaft;

and shoulder means on said disks engaging said combination spacer and mounting means.

18. A shaft assembly according to claim 17, wherein
35 said combination spacer and mounting means comprise molded elastomeric members, and said members and said shaft having means keying the members corotatively with the shaft.

19. A shaft assembly according to claim 17, including means keying said disks corotatively with respect to the shaft.

- 5 20. A shaft assembly according to claim 17, including means maintaining said spacer means under longitudinal snug-up pressure along said shaft.

FIG. 1

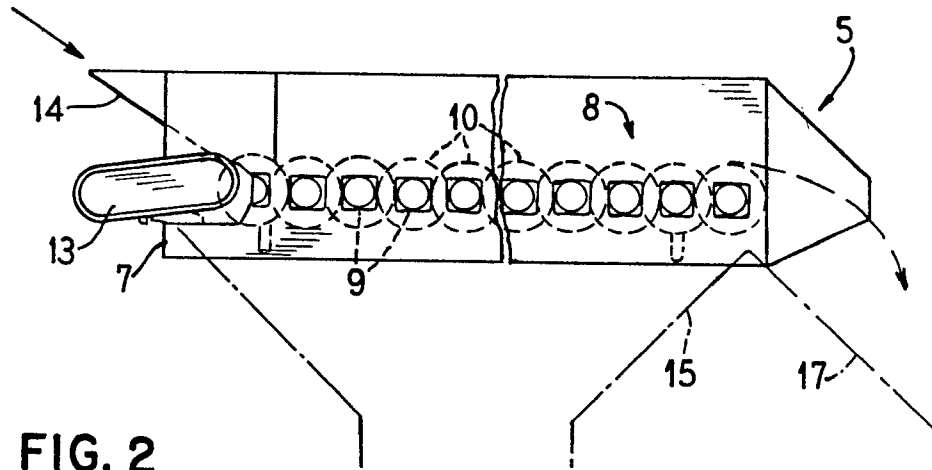


FIG. 2

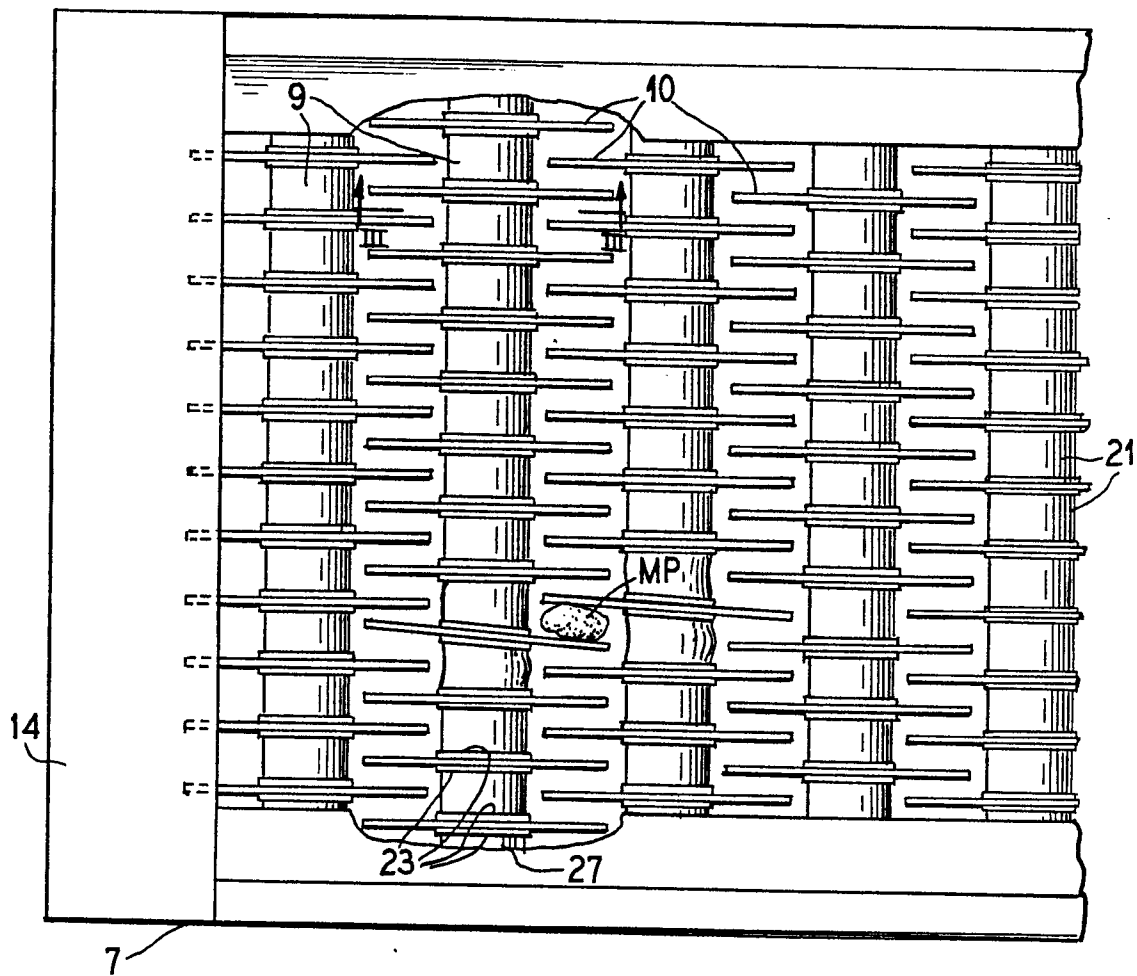


FIG. 4

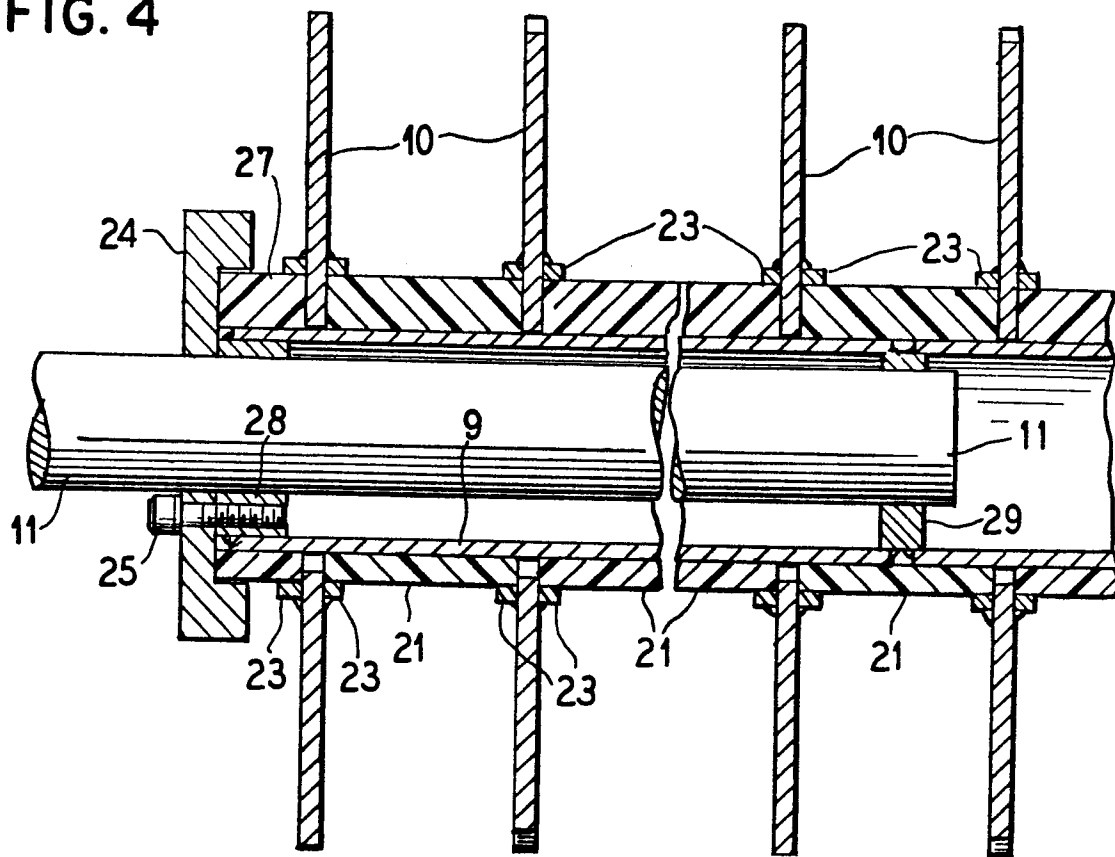


FIG. 3

