April 8, 1941. W. H. KUTZ 2,237,491

SHAKER SCREEN

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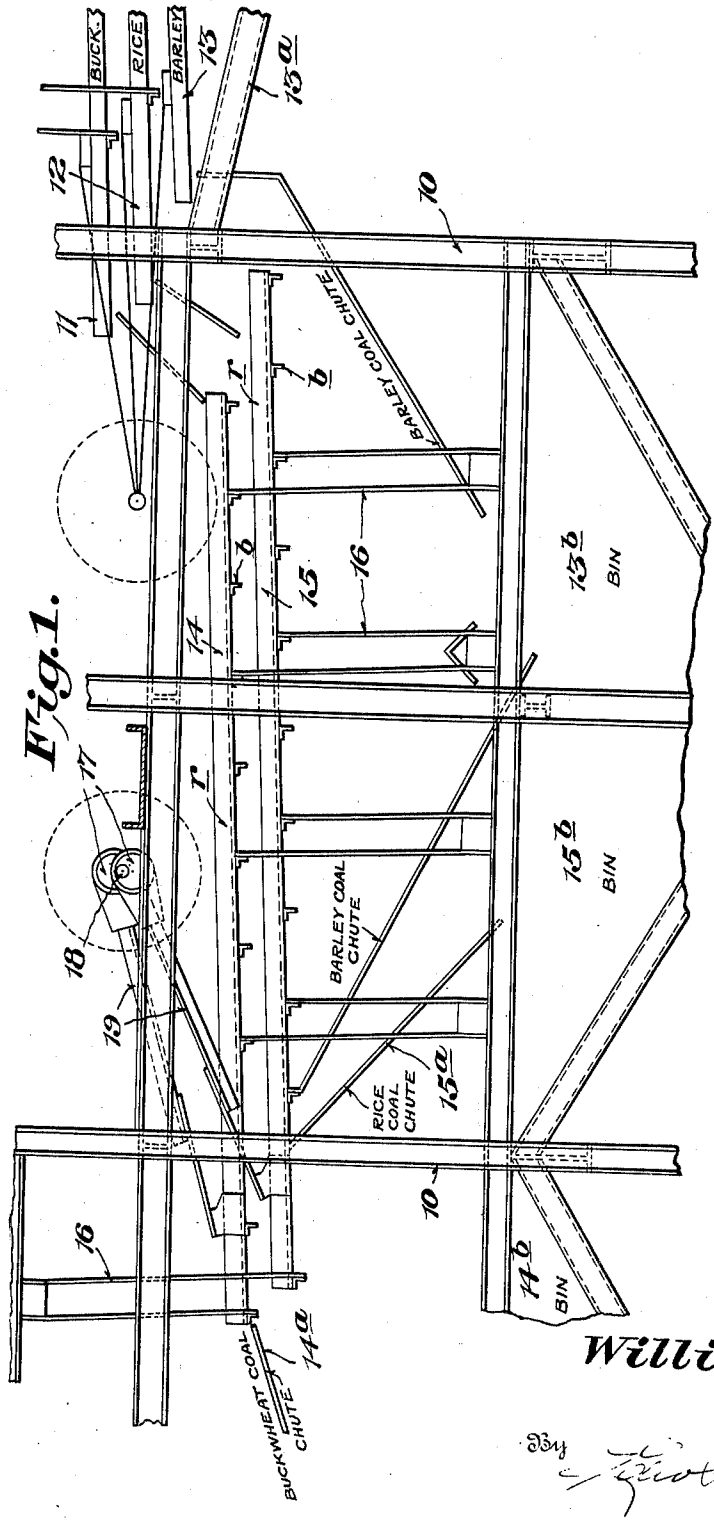


Fig. 1.

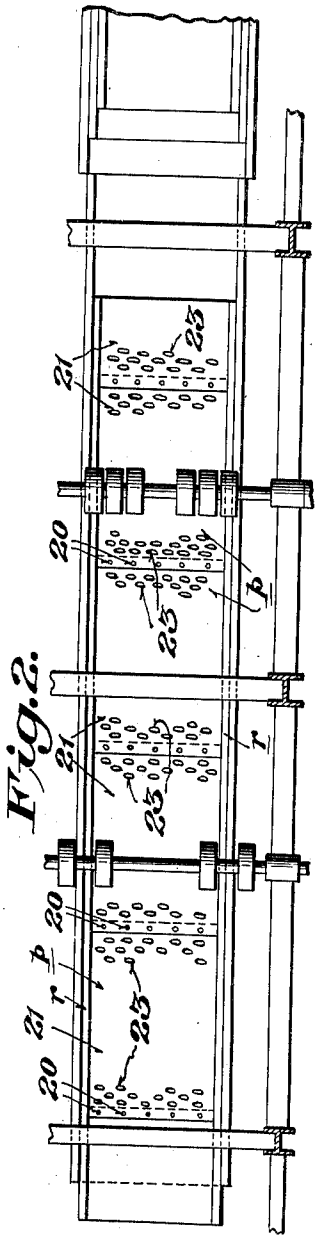


Fig. 2.

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Fig. 3.

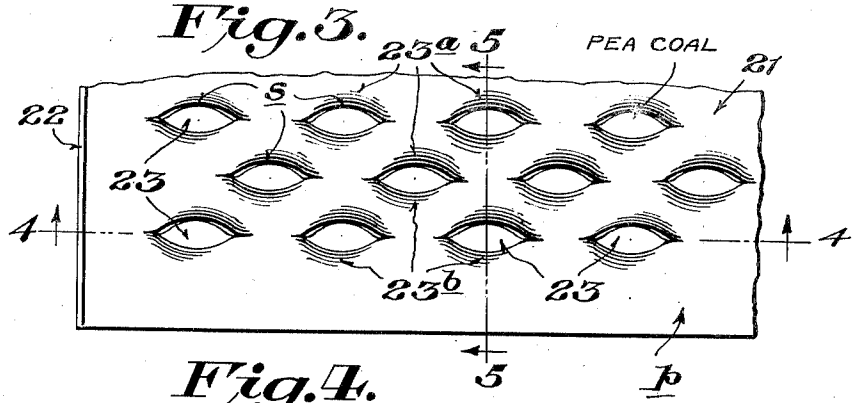


Fig. 4.

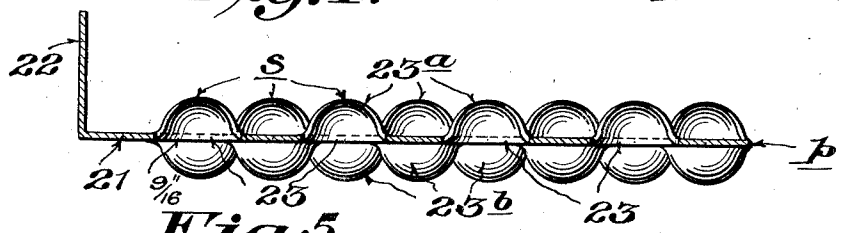


Fig. 5.

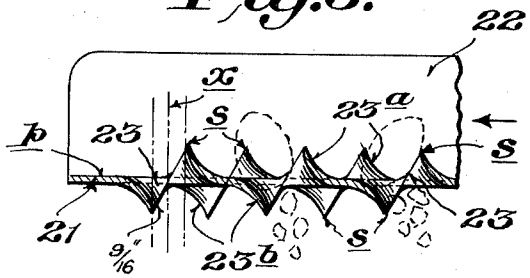


Fig. 6.

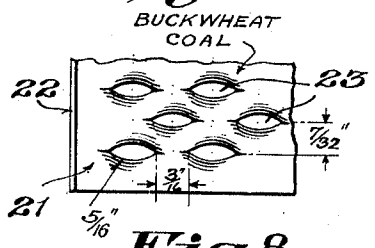


Fig. 7.

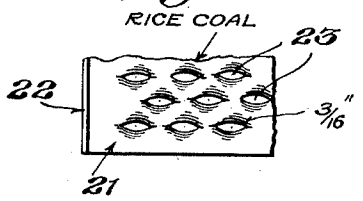
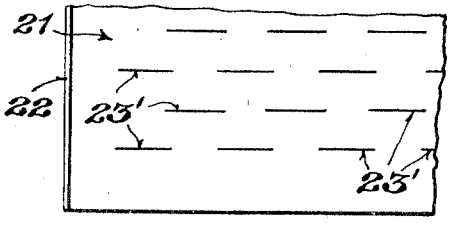


Fig. 8.



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UNITED STATES PATENT OFFICE

2,237,491

SHAKER SCREEN

William H. Kutz, Summithill, Pa.

Application September 20, 1938, Serial No. 230,875

1 Claim. (Cl. 209—397)

The present invention relates to sizing of crushed coal and stone, and is particularly useful and designed for sizing anthracite coal, known as buckwheat, rice, barley, and bird's-eye.

In the present practice of sizing coal, the coal is passed over a series of shaker screens, different sizes falling from one to the other and eventually being separated into different bins for the various sizes. The shaker screens as employed consist of metal plates having holes or openings therein of a size for separating a particular size from the rest of the coal passing over the surface of the screen, these screens being gigged or moved or vibrated in any appropriate manner which will produce a shaking, sifting action. These openings, however, in the screen are made with their axes perpendicular to the metal plate.

In practice the bulk or mass quantities flowing over the surface of the screen tends to pack and slide off the screen without producing an effective separation of the desired size or any particular screen and this bulk or mass tends to clog or block the holes or openings, large pieces of coal tending to settle in the openings and prevent the smaller size from entering the openings and be separated. After very little use these openings become so clogged that the screen is useless and has to be discarded, the coal packing in the openings so tightly and becoming so hard that it is difficult as well as impractical to clear these openings because of the innumerable holes in the plate.

The object of the present invention is to overcome the above stated drawbacks with novel and efficient means which prevent the coal, moving over the surface of the screen, from packing thus permitting a thorough separation of the larger sizes from the smaller sizes, and which will prevent the openings from becoming clogged, thereby increasing the life and usefulness of the screen many times over present practices with screens now in use or otherwise known for this purpose.

More specifically, the object of the invention is the provision of a shaker-screen particularly designed for sorting sizes of coal and which comprises a metal plate having a plurality of closely positioned rows of openings in the major portion of its area, the axes of the openings being on an inclined plane with respect to the surface of the screen and the openings at the upper or material supporting surface being arranged in the line or direction of flow of the material and having their edges arched on opposite sides of the plate, whereby the edges of the openings on the upper side of the plate will break up any bulk or packed mass of material flowing over the surface of the screen and will turn the larger pieces of coal on edge, during the shaking operation, to prevent them from blocking or clogging the openings, which, because of their inclined position in the direction of flow of the coal, will readily permit the smaller sizes to enter therein and pass therethrough.

It is a further object of the invention to provide the opennigs sufficiently close so that openings in adjacent transverse rows on the screen will overlap each other and the distance between each row being only sufficient to form a web that will insure the integrity of the screen in operation, the arched edges of the openings serving as reinforcements stiffening the body of the screen and preventing it from sagging or bending in operation under the weight of the material thereon, thus providing a firm, rigid screen.

A further object of the invention is the provision of a shaker-screen having openings therein, the edges of the openings being arched and rising from the surface of the screen, whereby the material passing thereover is distributed evenly over the surface of the screen during the shaking operation.

With the above and other objects in view, the invention resides in the sundry details of construction, combination, and arrangement of parts hereinafter more fully described and pointed out in the appended claim.

In the drawings, which show the preferred embodiment of the invention—

Figure 1 is a side elevation of the shaker separating or sorting screen arrangement usually found in a coal collier and equipped with the present invention;

Figure 2 is a top plan view of Figure 1;

Figure 3 is a fragmentary plan view of a shaker screen plate showing in detail the formation of the openings therein;

Figure 4 is a transverse sectional view taken substantially on line 4—4 of Figure 3;

Figure 5 is a longitudinal sectional view taken through the shaker screen substantially on line 5—5 of Figure 3;

Figures 6 and 7 are fragmentary sectional views showing the relative size of the openings in the screen for buckwheat and rice coal, respectively; and

Figure 8 is a plan view illustrating one step in producing the shaker screen.

Referring in detail to the drawings, a separator is shown in Figure 1 comprising a framework 10 upon which is suitably supported shaker

screens 11, 12, 13, 14, and 15 by flexible suspension rods or bars 16 or any other suitable means, these shaker screens being vibrated, as for instance, by eccentrics 17 on shafts 18. The eccentrics may be connected to the screens by shaker rods 19 in a well known manner.

It will be understood, of course, that there are a large number of the shaker screens for sorting the different sizes of coal particles, a portion of the separator for separating buckwheat, rice, and barley sizes being shown in Figures 1 and 2 for the purpose of illustrating the application of applicant's invention. In practice, for instance, a portion of coal of buckwheat size and those less than buckwheat size will have been collected by the screen 11 which will separate the buckwheat from the rice and less sizes, the latter being discharged onto the screen 12 which will separate the rice from the barley and the screen 13 will separate the barley from the still smaller sizes, the latter dropping into chute 13*a*. The buckwheat sizes from the screen 11 will pass to screen 14 where it is again subjected to a re-screening operation to separate it from the sizes less than buckwheat which drop upon the screen 15, whereas the buckwheat will pass from the screen 14 onto the discharge chute 14*a*. Rice size coal will pass from the screen 12 onto the screen 15 where it is re-screened; the rice sizes passing from the screen 15 onto the discharge chute 15*a* into a rice bin 15*b*; the barley size dropping into the bin 13*b* from both the screens 13 and 15. The screens are preferably slightly inclined downwardly from the point of delivery of the coal thereto to a discharge end for facilitating its flow thereover, as can be clearly seen from the drawings. The screens are composed, preferably, of spaced side rails *r* connected on their under side at spaced intervals by transverse bars *b* or rods. Between the side rails *r* and upon the bars *b* are disposed metallic perforated plates *p* arranged end to end with their adjacent edges slightly overlapping and secured together, and to the bar *b*, by rivets or bolts 20. These shaker plates *p* ordinarily vary in length from four to six feet so as to enable a portion of the screening surface of any shaker screen to be replaced in the event of damage, as well as to facilitate handling and assembling.

In accordance with the present invention the character of the openings provided in this plate *p* is the important desideratum. These openings 23 are provided on centers close enough together to prevent any considerable space between one opening and the other, the spacing being sufficient only to permit the formation of the openings of the particular size coal to be separated (for instance,—the openings for pea coal screen should be approximately $\frac{9}{16}$ of an inch, buckwheat approximately $\frac{5}{16}$ of an inch, rice approximately $\frac{3}{16}$ of an inch, barley $\frac{1}{16}$ of an inch).

These shaker plates *p*, as shown in Figs. 3, 4, and 5, preferably consist of a flat body portion 21 having upturned side edges 22 to form retaining side flanges. Substantially the entire surface of the plate is provided with substantially circular openings or perforations 23, whose axes are inclined at an angle of approximately 30° (a little more or a little less) to the plane of the body 21 of the plate, said openings on the upper side of the plate *p* facing in the direction of flow of the material passing over the plate. These openings are, preferably, arranged in staggered rows transverse of the screen or plate 21, the openings in one row overlapping the openings in an adjacent row and the spacing between each opening of each row being less than the diameter of the openings and the distance between each row being approximately the width of the openings—for instance, in the case of buckwheat screen plate having about $\frac{5}{16}$'' openings, the distance between openings in a row is about $\frac{3}{16}$'' and the distance between openings in adjacent rows is about $\frac{7}{32}$'', see Figure 6.

The material of the plate 21 defining these inclined openings 23 is upset so as to arcuately offset opposite halves of the edges of the openings on opposite sides of the plate 21. Thus the forward half 23*a* of the edge of each inclined opening 23 rises from the upper surface of the plate 21 in an arched or arcuate form and has its crest portion S tipped upwardly to present itself for a scraping or biting action on the material passing over the plate body, while the rear half 23*b* of the edge of each opening 23 of the plate is similarly formed and projects downwardly from said under surface, thereby providing reinforcing ribs to give stiffness to the perforated plate 21. By the close disposition and the staggered arrangement of the openings 23 the edges 23*a* and 23*b* give a corrugated reinforcement on opposite sides of the plate 21 in a transverse, longitudinal, and diagonal direction. Also these offset edges 23*a* and 23*b*, because of the inclined angularity of the axis of their opening, lie in a plane making an angle of approximately 60°, a little more or a little less, with respect to the plate body 21 and are spaced from a line *x* (Figure 5) perpendicular with respect to the upper and bottom surface of the plate body 21 and intersecting the axis of the opening, thus permitting small or fine particles to fall vertically through the openings.

By the construction and disposition of the opening 23 and their edges, many advantages are obtained in the shaker screen; and, in addition to the advantages above mentioned, the upwardly extending edges 23*a* serve three other functions, namely: (1) they act to break up bulk or mass of material which has become packed, thus separating the particles of coal from the packed mass; (2) they act upon larger particles of material to constantly turn them over and prevent them from obstructing or clogging the openings 23 and tend to push them forward during the shaking vibrations of the screen; (3) because of the fact that the openings 23 face forwardly of the direction of flow of the material thereover, these edges 23*a* shield or hood the openings from the force or pressure of on-flowing material which may clog the openings.

As one means by which the perforations 23 may be provided in a screen body 21, the plate 21 (Fig. 8) may be stamped to provide a plurality of spaced transverse slits 23' therein, and a suitable tool or tools may be extended through these slits at an inclined angle with respect to the plate 23*a*; or the slitted plate may be subjected to the action of opposing dies which will open the edges of the slits to form the openings, as shown and described in Figs. 3 to 7 inclusive. Of course, the slitting, punching or stamping operations may be combined into one step.

From the above it will be observed that a very practical separating shaker screen has been provided, which overcomes many of the drawbacks present and unavoidable in screens now in use, and the openings of which will have less tendency

to clog or become blocked, that the particles of material passing over the screen which are larger than the openings therein will be constantly agitated by the edges of the openings themselves and prevented from lodging in the openings, that the edges of the openings tend to break up any mass of material which would pass over the screen, that the inclined openings will permit the smaller particles of material to be separated will more readily pass through the openings as the vibrating motion of the screen is partially in alignment with the axes of the opening and aids in forcing the smaller material through the openings in the screen, yet the edges of the openings will permit particles to drop vertically through the openings, that the arched edges of the openings will reinforce the perforated body portion 21 to stiffen it against sagging or warping under the weight of the material passing thereover, while permitting the openings to be closely spaced apart, and will distribute the material to be separated over the entire area of the screen.

It is to be understood that the invention is not limited to the specific details herein shown and described as the invention contemplates all changes and modifications which fall within the scope of the appended claim.

What is claimed is:

In a coal shaker screen, a flat screen body having a plurality of closely arranged substantially circular openings in its area and extending through the surfaces thereof with their axes extending obliquely to the body and facing with the direction of flow of the material to pass over the upper body, said openings being formed by a plurality of slits in the screen body and arranged in transverse staggered rows and oppositely offsetting the edges of each slit in a concavo-convex formation from the ends thereof with the crest of such offset edge of each slit above the upper face of the body, at least, being tipped, upwardly to present a scraping or biting edge to the material passing over the body, said offset edges of each slit lying in the same oblique plane, said plane making an angle of approximately 60° with respect to the body, the distance between the openings in each row being less than the diameter of said openings and the distance between the openings of each row being less than the diameter of said openings.

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