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GRADING DEVICE

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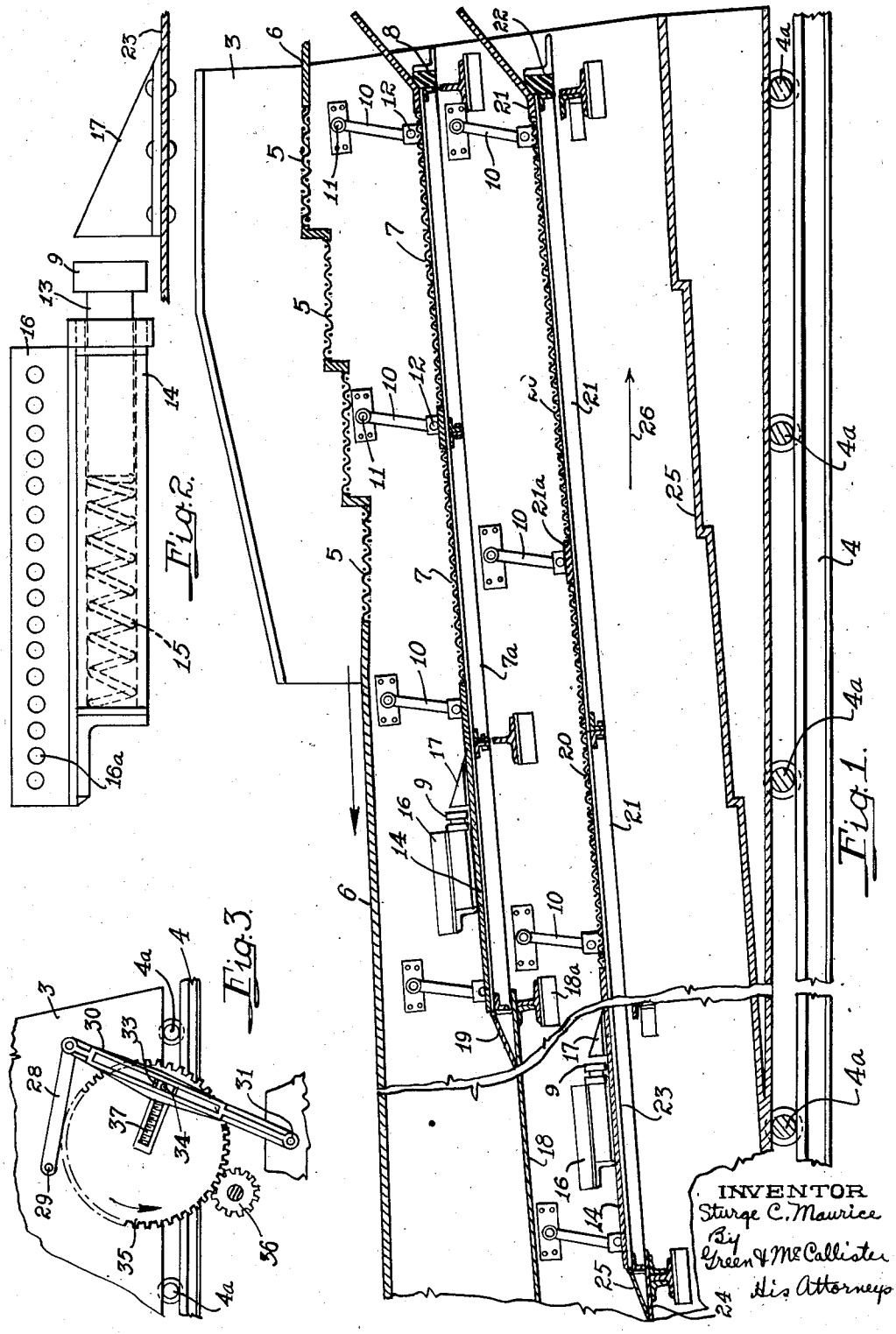

Fig. 1.

Fig. 2.

Fig. 3.

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GRADING DEVICE

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This invention relates to means for grading material such as coal and has for an object to produce a coal grading device which is effective in operation and which is of simple structure. A further object of this invention is to produce a grading device of the type indicated which will effectively and efficiently separate material such as run of mine coal into at least four grades such, for example, as egg coal, nut coal, pea coal and slack coal.

Material grading devices are well known and it is old practice to employ a series of vertically arranged screens of different mesh for the purpose of accomplishing a desired grading of materials such as grain, ore and coal. My invention, however, relates particularly to specific structural features which contribute to simplicity of structure and effectiveness in operation of such devices.

In the drawing accompanying and forming a part hereof, Figure 1 is a diagrammatic sectional view of a coal grading device embodying my invention, a portion of the device being broken away for convenience of illustration. Figure 2 is a somewhat diagrammatic view of a spring bumper shown in association with a stop, forming a part of the structure illustrated in Figure 1. Figure 3 is a fragmental view on a reduced scale and illustrates a driving mechanism which may be employed for the grading device.

As illustrated, the grading device includes a trough-shaped frame 3 which is so mounted that it is capable of being reciprocated in a horizontal direction, i. e., moved back and forth along its supporting base. While the mounting means employed forms no part of my invention, I have diagrammatically illustrated the trough-shaped member 3 as mounted on rails 4 by means of rollers or flanged wheels 4a, which facilitate the reciprocatory motion and which are so arranged as to guide the frame during its reciprocations.

As illustrated, the frame 3 supports a grading screen 5 which is shown divided into relatively short sections located in stepped relationship relatively to each other. The screen sections 5 intervene in a coal supporting floor 6 which constitutes a part of the structure 3, bridges the space between the side walls of that structure and is preferably rigidly secured to those side walls. In the coal grading device illustrated the screen sections 5 are of such mesh as to pass all coal smaller than egg coal. It will be understood that each screen section is so mounted in the floor 6 that it holds its shape under the varying load conditions encountered during operation.

Screen sections 7 are mounted in a frame 7a which is suspended below the screen sections 5. Frame 7a is diagrammatically shown formed of angle irons and is sufficiently rigid to prevent the screen sections 7 from distorting under the varying load conditions encountered. One of the features of the present invention is that the screen frame 7a is suspended from the side walls of the trough-shaped section and is capable of swinging relatively thereto through a short arc. The extent or amplitude of the swing is limited at one end by a buffer 8 and at the other end by a spring bumper 9. As illustrated, the screen sections 7 and their supporting frame 7a are suspended by means of links 10, one end of each of which is pivotally secured to one side of the trough-shaped member 3 while the other end is pivotally secured to one side of the screen frame 7a. It will be understood that each side of the screen frame 7a is supported by links 10 and that the screen frame is of such width, with relation to the width of the trough-shaped structure 3, as to provide for the free swing of the frame but at the same time prevent the passage of coal of appreciable size between the sides of the screen frame and the sides of the trough-shaped structure.

The screen frame is so suspended that it is inclined downwardly in the direction of coal movement across it. In addition, each suspending link 10 is so positioned with relation to its supporting trunnion 11 and its frame-connecting pin 12 that the frame is normally held by its own weight against the buffer or buffers 8. In the illustrated embodiment the buffer or buffers 8 are formed of rubber or some such resilient material and are supported on angle irons which constitute cross struts of the structure 3. Each bumper 9 is mounted on a side wall of the structure 3.

As shown, each bumper is provided with an extension 13 which projects into a pipe section or cylinder 14 and butts against a coil spring 15 located within the cylinder. As shown, the cylinder 14 is carried by an angular bracket 16 which is adapted to be mounted on one of the side walls of the trough-shaped structure 3. As illustrated in Figure 2, the screen frame 7a may be provided with an upwardly projecting block or stop 17 which is adapted to engage the bumper 9 and thus limit the swing of the screen in one direction. It will be understood that the screen frame will preferably be provided with two such stops, located on opposite sides thereof, and that each such stop will cooperate with a separate

bumper 9 and thus avoid placing a side or twisting strain on the screen and screen frame each time its movement is stopped as it swings in the direction of coal movement across it. The angle bracket 16 is provided with a plurality of bolt-receiving apertures 16a to accommodate mounting the bumper in the desired or an adjusted position with relation to its cooperating stop 17. It will be understood that each such bracket is bolted to a side wall of the structure 3 by means of bolts which pass through some of the apertures 16a and suitably located bolt-receiving apertures in such side walls.

In the illustrated embodiment, screens 7 are intended to pass all coal of less size than nut coal and are so positioned with relation to a floor 18 that the nut coal moving across them is delivered onto the floor 18 and moved across that floor in response to the reciprocations of the trough-shaped structure 3. As shown, floor 18 is downwardly inclined in the direction of coal movement and is rigidly secured to the side walls of the structure 3. It bridges the space between the side walls of the trough-shaped structure and is supported by cross-struts 18a of that structure. In order that material moving off of the screen frame 7a may be effectively delivered to the floor 18 and also that the relative movement of the screen frame 7a with relation to the floor 18 will contribute to the delivery of the coal along the floor, I provide the lower end of the screen frame with a plate 19 which is hinged thereto with its free edge riding on the floor 18. The plate is substantially the width of the floor 18 and provides a way across which coal moves from the frame 7a onto the floor.

Screen sections 20 are carried by a frame 21 which is suspended from the side walls of the structure 3 and is located below the screen frame 7a. The screen frame 21 is so formed and the screen sections are so constructed as to prevent the frame and the screens from sagging or bending under varying load conditions. The sections 20 are of smaller mesh than the screen sections 7 and, in the illustrated embodiment, are adapted to pass all coal smaller than pea coal.

As shown, the screen made up of the sections 7 is longer (in the direction of coal travel across it) than the screen made up of sections 5. Likewise, the screen made up of the sections 20 is longer than the screen section of the frame 7a. The screen frame 21 is inclined downwardly in the direction of coal movement; is suspended by means of links 10 from the side walls of the structure 3 and the links are so arranged as to normally hold the upper end of the frame against a buffer or buffers 22 carried by the structure 3. The swinging movement of the screen frame 21 is limited in one direction by the buffer or buffers 22 as described in connection with screen frame 7a, and its movement in the opposite direction is limited by one or two bumpers 9. The relationship between the screen frame 21 and its movement-limiting bumpers 9 is the same as that described in connection with screen frame 7a, and the screen frame 21 is therefore provided with a block or blocks 17 for engaging the bumper or bumpers 9 which, as previously described in connection with the screen frame 7a, are also carried by the side wall of the structure 3.

As shown, an imperforate plate 23 is carried by the frame 21 and therefore swings with the screens 20. As a result, the nut coal, moving off of the screens 20, continues to move downwardly across the floor 23 and is finally delivered onto a floor 24 which forms a part of and moves with the structure 3. As illustrated, the lower end of the frame 21 is provided with a plate 25 pivotally secured thereto, and which is similar in structure and function to the plate 19 in that it constitutes a way over which coal passes onto the floor 24 and contributes to the movement of coal along the floor 24.

The coal-receiving bottom 25 of the trough-shaped section 3 is preferably downwardly inclined in the direction of coal movement along it and may be formed in steps, as illustrated, for the purpose of facilitating the movement of the coal along it. It will be understood that the coal traversing each of the floors 6, 18, 23 and 24 is delivered, by separate conveying means, to a separate bin or receptacle, as is usual in connection with grading devices. Such conveying mechanisms or chutes form no part of the present invention and consequently are not illustrated.

In order to render the device illustrated highly effective as a grading device, I prefer to employ a reciprocating mechanism for the structure 3 which moves it more rapidly in the direction of the arrow 26 of Figure 1 than in the opposite direction, and I have diagrammatically illustrated a mechanism for accomplishing such a movement. As there shown, the driving means includes a link 28 operatively coupled to the structure 3 by means of a pivot pin 29. The link is actuated by means of a lever 30 which is fulcrumed at 31 and which is slotted midway of its length to receive a block 33. The block is pivoted on a pin 34 which is carried by a gear 35.

The gear is mounted for rotation in any suitable and rigidly supported bearing and is driven in a counter-clockwise direction by means of a pinion 36. With this arrangement the structure 3 is moved more rapidly in the direction opposite to that of coal travel along the screens than in the direction of coal travel, with the result that the cooperative action of the bumpers 9 and the driving mechanism so influences the swing of each of the screen frames 7a and 21a as to accomplish an effective shifting of the coal on the screens and at the same time a propelling of the coal in the desired direction of travel.

As shown, the pin 34 and the block 33 are adjustable radially of the gear 35 by means of a screw 37. This is ordinary and usual construction and therefore is not fully illustrated. It, however, will be apparent that by shifting the block 33 toward and away from the center of rotation of the gear 35, the amplitude of the reciprocations of the structure 3 will be varied. This in turn will cause some change in the movement of the coal on the various screens and will thus have some effect on the grading operations.

While I have described but one embodiment of my invention, it will be apparent that various changes in the structural details and additions and omissions may be made in the apparatus illustrated without departing from the spirit and scope of my invention as defined by the appended claims.

What I claim is:

1. In combination in a grading device a trough-shaped structure mounted for reciprocatory movement, a conveyor floor inclined to the horizontal, extending substantially in the direction of movement of said structure and fixedly secured thereto above the bottom thereof and including at least one grading screen intermediate its ends,

a swinging screen located within said structure, suspended from the walls thereof below said first-mentioned screen and inclined to the horizontal, stops for limiting the swing of said swinging screen located at opposite ends thereof, one such stop engaging the upper end of said screen and so positioned that said screen is normally held against it by the weight thereof and means for reciprocating said structure and moving it more rapidly in the direction of travel of material over said floor than in the opposite direction.

2. In combination in a grading device, a trough-shaped structure mounted for reciprocatory motion, a conveyor floor inclined to the horizontal, extending in the direction of said structure and fixedly secured thereto, a series of screens located in stepped relationship and constituting an intermediate part of said floor, a second conveyor floor located below said first-mentioned floor extending substantially parallel thereto and fixedly secured to said structure, a swinging screen located within said structure below said first-mentioned screens and overlapping said second floor, links pivotally secured to said structure and to said swinging screen and supporting said screen in an inclined position, a separate stop located at each end of said swinging screen and carried by said structure for limiting the amplitude of the swing of said swinging screen, the stop located at the upper end of said screen being so positioned that the swinging screen is normally held against it by gravity, and means for reciprocating said structure and moving it more rapidly in the direction of travel of material to be graded over said floors than in the opposite direction.

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