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ADJUSTABLE SPIRAL SEPARATOR.

To all whom it may concern:

Be it known that I, FRANK PARDEE, a citizen of the United States, and resident of Hazleton, Pennsylvania, have invented certain new and useful Improvements in Adjustable Spiral Separators, of which the following is a specification.

This invention relates to spiral separators and particularly to improvements in the construction of the runways thereof. Heretofore coal separators of this type have usually been constructed of a number of fixed sections forming a spiral runway of fixed diameter substantially uniform throughout the length of the separator and various expedients have been adopted for varying the friction of different portions of the runway so as to assist in causing the purer coal and slate or other refuse to travel in different paths along the runway.

The present invention is an improvement over prior constructions and includes means whereby the width or supporting area of the runway can be varied so as to release the purer coal traveling near the outer periphery thereof so that it can be caught and conveyed by a suitable conveyor thread.

The improved structure also is arranged so that as the width of the runway is varied the friction exerted on the material traveling thereon is also varied at the same time.

The invention as illustrated in the accompanying drawings shows several embodiments thereof in which—

Fig. 1 is a somewhat diagrammatic side elevation of a coal separator illustrating one embodiment of the invention;

Fig. 2 is a plan view of the spiral separator showing one complete turn;

Fig. 3 is a fragmentary plan of parts shown in Fig. 2, one adjustable portion being shown in its outer position;

Figs. 3a and 3b show modified arrangements;

Fig. 4 is an enlarged view showing details of construction of one adjustable section of the runway;

Fig. 5 is a section on the line 5—5 of Fig. 4;

Figs. 6, 7 and 8 are sections on the correspondingly numbered lines of Fig. 4;

Fig. 9 is an enlarged view showing details of construction;

Figs. 10, 11 and 12 are fragmentary views showing an alternative arrangement to that illustrated in the foregoing figures;

Figs. 13 and 14 show different positions of the adjustable sections in a modified form of the device;

Figs. 15, 16 and 17 are detail sections on the correspondingly numbered lines of Figs. 13 and 14;

Fig. 18 is a partial plan view showing another modified structure for varying the width of the runway;

Fig. 19 illustrates the adjustable sections of Fig. 18 in another position;

Figs. 20 and 21 are partial plan views illustrating different positions of a further modified construction;

Figs. 22 and 23 illustrate a further modification.

Referring to Fig. 1 the separator comprises a central supporting post 1 having a series of upwardly and outwardly extending rods 2 which are adapted to support the various fixed and movable sections of the runway 3. The separator may be made with one or more separator runways as desired, Fig. 1 showing a separator having three such runways. The central post 1 also carries a series of spirally arranged rods 4 which support an outer conveyor thread 5 which is adapted to catch the coal which flies off of the separator threads 3 as it travels along the runway. The conveyor 5 communicates at the bottom with a suitable chute adapted to lead the coal to a storage bin, not shown. Coal is fed to the runways or separator threads 3 from suitable feed chutes 6 which are pivotally secured at 6a to the upper ends of said separator threads and adjustable held in an inclined position by means of the hangers 7. At the upper end each separator thread is provided with flanges 8 adapted to prevent the mixture of coal and impurities from flying off the runway as it is initially fed from the chute 6. These flanges 8 extend approximately half way around the upper end of each separator thread.

Each separator thread 3 is identical in construction and therefore a description of one will suffice for all. These separator threads each consist of a runway including a plurality of upwardly and outwardly extending fixed plates 9 which are secured to the supporting rods 2. Similar plates 10
of less width than the plates 9 are also secured to the rods 2. Between the plates 9 and 10 are located adjustable sections 11 arranged to vary the width of the runway at different locations along the spiral thread of the separator. Each adjustable section 11 includes an outer plate 12 having a downwardly extending pivot 13 formed thereon which passes through a suitable opening in the supporting rod 2. The opposite end 14 of this plate rests freely on another supporting rod 2 and underlies the adjacent fixed plate 10. The inner part of this adjustable section is formed in the shape of a substantially triangular plate 15 which is pivoted at 16 to the rod 2 and rests on top of a fixed gusset plate 17 secured to the supporting rods 2 adjacent to the central post 1. The plate 15 also projects underneath the adjacent fixed plate 10. The plates 12 and 15 are preferably, though not necessarily, smooth so as to permit the materials to travel quite freely thereon without undue friction. Between the plates 12 and 15 are located a plurality of parallel bars 18 each of which is provided with a downward pivot portion 19 extending through a suitable aperture 20 formed in the supporting rod 2. The several rods 18 and the plates 12 and 15 are connected to one another by a rod 21 extending through elongated slots 22 formed in the bars 18. The rod 21 is provided with a plurality of collars 23 and cotter pins 24 to hold the bars in substantially uniform spaced relation to one another and yet permit them to be swung about their pivots 19. The plates 12 and 15 are provided respectively with downwardly extending flanges 25 and 26 through which the bar 21 also extends, suitable collars 27 and 28 being provided to operatively connect the rod 21 with said plates 12 and 15.

The bars 18 at one end are of reduced depth to form extensions 29, Fig. 5, which rest on the adjacent rod 2 and extend under the fixed plate 10. The several bars 18 and plates 12 and 15 form a grating over which the material to be separated travels. It is apparent the frictional effect on the material can be varied by adjusting the angular position of the bars. It will also be understood that when this grating is swung inwardly or outwardly the width of the runway at that location is respectively decreased or increased, as illustrated in Figs. 2 and 3 which show the adjustable sections 11 in two different positions.

The fixed plates 9 and 10 of the runway are provided to conform to a substantially true spiral surface, that is to say, they are not merely flat plates set at an angle. The supporting rods 2, however, are straight ones extending outward and upward from the central supporting post. The free ends 29 of the bars 18 extend under the plates 10 and rest freely on the rods 2, so that the sections 11 can be readily adjusted inwardly or outwardly as desired, the bars 18 and plates 12 and 15 at such times swinging about their respective pivots. It will be readily seen that the supporting surface of the adjustable sections will maintain practically the same pitch or downward and inward inclination at different positions of adjustment but that the width of the runway will be varied and that also the lengthwise angular position of the bars 18 will be varied, as comparison of Figs. 2 and 3 will show. It is clear that this change in direction of the bars will vary the frictional effect on the coal and slate or other materials traveling thereon. The bars as shown present their edges to the materials traveling thereon and exert what may be termed an “edge friction” on the material.

The bars 18, if desired, may be curved in plan as in Fig. 3 instead of being straight as shown in Figs. 2 to 4. The curvature being either concentric with the central post when the adjustable section is in its inward position or otherwise as conditions may deem necessary or desirable. The bars need not necessarily be exactly parallel with each other and could be of other forms than arcuate formation. Instead of pivoting each bar on an individual pivot they could also be rigidly secured to suitable cross bars 18 underneath to form a grid 18' which could be swung as a unit about a single pivot 19 as shown in Fig. 3.

In Figs. 1 to 8 the adjustable sections are pivoted at a location on the runway lower than their swinging or free ends, the material to be separated flowing clockwise as indicated by the arrow in Fig. 2. In other words, in these views the material flows toward the pivots of the bars. Figs. 10, 11 and 12 show an alternative arrangement in which the bars 18 and plates 12 and 15 are pivoted at points on the spiral runway higher than their free or swinging ends. In other words the material flows away from the pivots or toward the free ends of these members. Each arrangement has advantages in handling different classes of coal. The structure of Figs. 1 to 8 is used with very good results in treating some classes of bituminous coal as it allows the coal to roll and gather speed and thereby separate in a distinct path from the slate and other impurities. It is known in this art that for some fructures of bituminous coal it is necessary to roll the coal rather than have it slide as to increase the speed thereof. The bars 18 as arranged in the first eight figures are arranged so that they can readily give the purer coal a more rolling motion and exert sufficient friction on the slate and other impurities which are usually of a
flatter fracture so that these waste products will travel on an inner path of the runway.

With the bars arranged as in Figs. 10 and 11, when they are swung inwardly from position shown in Fig. 10 to that shown in Fig. 11, the friction on materials is increased thereby holding the outer plate and other refuse and accelerating the movement of the coal by causing it to roll. Friction of this sort has a slowing up effect on the refuse material but for the glossy or purer coal the tendency is to increase the speed by causing it to roll, therefore, increasing the centrifugal force which causes it to skim it off onto the conveyor thread. When the bars are swung outwardly toward the outer edge of the runway as in Fig. 10, they follow more closely the natural lines or path of travel of the purer coal and therefore tend to aid in throwing it off to a much greater extent than the slate and other impurities, the natural line of travel of the slate being nearer the central post. The bars in this position tend to produce a frictional drag on the slate and other waste materials and direct them toward the inner path. Either of the above described structures, it will be seen, can be arranged so as to both vary the width of the runway and also vary the amount of friction exerted on the material flowing over the runway.

For swinging the adjustable sections I provide a spiral bar R which is slidably mounted in suitable brackets secured to the underside of the fixed sections of the runway. This bar is connected by short links L to the outer plates 12 of each of the adjustable sections. A hand lever H is pivoted at P to any convenient fixed part of the runway and is connected by a pin r and slot k to the spiral bar R. It is clear that by moving the lever H the several sections can be simultaneously adjusted. The hand lever H carries a spring pressed latch rod A, the lower end of which is adapted to engage notches in a fixed ratchet sector S so as to hold the sections 11 in their various adjusted positions, the latch rod being operated by a bell crank hand grip lever E.

Instead of using the pivoted members above described for varying the width of the runway, I may employ other expedients such as shown in Figs. 13 to 23.

Figs. 13 to 17 show a runway comprising fixed segments 30 and 31 supported at their upper radial edges 32 on the rods 2 secured to the central post 1. Sliding plates 33 and 34 are formed with sleeve portions or heads 35 which embrace the supporting rods 24. The lower edge 36 of the plate 33 overlaps the upper radial edge of the plate 34 as shown in Fig. 15, and the inner edges 35' and 36' also overlap the fixed gusset plates 37 secured to the supporting rods. The fixed segments 30 and 31 may be of uniform size throughout the entire length of the spiral or the upper segment 30 may be of greater radial length than the segment 31 as shown, the intermediate segments being uniformly graded in size. The effective width of the runway at desired locations can be varied by sliding the plates 33 and 34 to different radial positions as comparison of Figs. 13 and 14 will indicate.

Figs. 18 and 19 show another arrangement in which movable plates 45 are provided with slots 46 through which pass screws 47 which are secured in the radial supporting rods 2. The plates can be either swung about the screws 47 as a pivot, or by virtue of the slotted connection they can be slidably adjusted inwardly or outwardly to secure various contours or variations of the width of the runway. The plates 45 are associated with fixed segmental plates 48 supported on suitable rods 3 similar to the structures already described.

Figs. 20 and 21 show a further modification wherein the width of the runway is varied by moving the plates 49 and 50 toward or away from the central supporting post. The plates are each provided with clamping screws 51 and 52 which pass through slots 53 and 54 formed in the fixed segments 55. On the underside of the segments 55 the screws 51 and 52 carry clamping nuts for securely holding the plates 49 and 50 in desired positions of adjustment. The location and direction of the slots 53 and 54 can be plotted to secure various directions of adjustment for the plates 49 and 50 as will be understood.

Figs. 22 and 23 show different positions of adjustment of a separator in which the runway comprises an upper fixed segment 56 and a series of movable segments 57 which overlap each other at their adjacent radial edges and are each pivoted at 58 to a spiral bar or bracket 59 which is carried by the central post. The segments 57 are notched at 60 so that when they are swung to the left, as in Fig. 23, they will clear the pivot studs of the adjacent section. By swinging the segments 57, Fig. 22, to the left they can be arranged to form a spiral runway of less diameter or width as shown in Fig. 23. If desired the segments 57 could also be arranged to swing to the right and a special segment provided to close the gap which would be thus formed between the fixed segment 56 and the adjacent swinging segment 57. The swinging segments at their outer ends rest on a spiral bar 61 which is carried by the rods 2 secured to the central post.

The adjustable plates of Figs. 13 to 23 inclusive can be provided with suitable ribs or roughened plates to increase the friction on the material traveling thereon. Illus...
oration of the ribs or other friction surfaces has been omitted from these figures in the interest of clearness.

From the foregoing specification it will be clear to those skilled in this art that separators herein described include improvements over prior constructions and provide means whereby a single separator may be used for treating or cleaning a great variety of coals or other materials. The adjustable sections providing means for releasing the purer materials and retarding the waste according to their varying natural characteristics.

While I have described with great particularity the embodiments of the invention herein illustrated, it is not to be construed that I am limited thereto as changes in arrangement and substitution of equivalents may be made without departing from the invention as defined in the following claims.

What I claim is:

1. A separator having a spiral separating runway and means for varying the width or supporting area of said runway so that a certain class of material traveling thereon can be centrifugally discharged at different radial distances from the axis of the separator.

2. A separator having a spiral separating runway and movable members forming part of the runway adapted to vary the width or supporting area thereof to control the radial zone at which a certain class of material will be discharged.

3. A separator having a spiral runway floor and means for simultaneously varying the supporting floor area of said runway and the frictional effect on the materials traveling on the runway.

4. A separator having a spiral runway including at least one section having a plurality of movable bars forming part of the runway floor arranged to vary the width of the runway and also the frictional effect on the materials traveling thereon.

5. In a spiral separator a movable grating arranged to vary the width of the runway and the frictional effect on the materials traveling thereon.

6. A spiral separator including at least one section composed of a plurality of members joined to one another and movable as a unit and arranged to vary the frictional effect on the material traveling on the separator.

7. A spiral separator comprising a central supporting post having a series of upwardly and outwardly extending supporting rods secured thereto, a runway comprising a series of spirally arranged fixed sections supported on said rods and intermediate sections movably mounted on other of said rods and arranged to vary the effective supporting area of the runway and to vary the distance from the axis at which the material will be discharged from the separator.

8. A spiral separator comprising a central supporting post having a series of upwardly and outwardly extending supporting rods secured thereto, a runway comprising a series of spirally arranged fixed sections supported on said rods and intermediate sections each comprising a plurality of members forming a movable grating adapted to vary the widths of the runway and the frictional effect on the materials traveling thereon.

9. A spiral separator comprising a central supporting post having a series of upwardly and outwardly extending supporting rods secured thereon, a runway comprising a series of spirally arranged fixed sections supported on said rods and intermediate sections each comprising a plurality of members and including a grating pivoted on certain of said supporting rods and arranged to vary the frictional effect on the materials traveling on the runway.

10. In a spiral separator, a runway having at least one movable section comprising inner and outer pivoted plates and a plurality of intermediate parallel pivoted bars forming part of the runway, said plates and bars being connected so they move together.

11. A spiral separator comprising a runway including a series of fixed sections and a series of gratings movable relatively thereto and arranged to vary both the frictional effect on the material traveling thereon and the radial zone at which the material will be discharged from the runway.

In witness whereof, I have hereunto signed my name.

FRANK PARDEE.