Dec. 1, 1942. W. M. SCHWEICKART 2,303,584

SCREW CONVEYER

Filed May 16, 1940 2 Sheets-Sheet 1

Fig. 1.

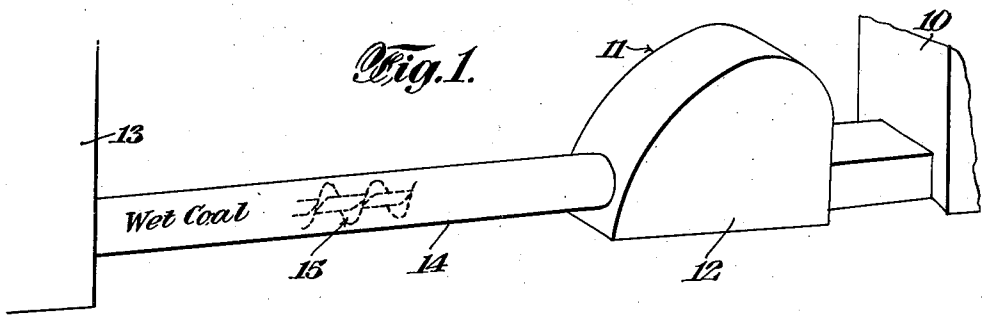


Fig. 2.

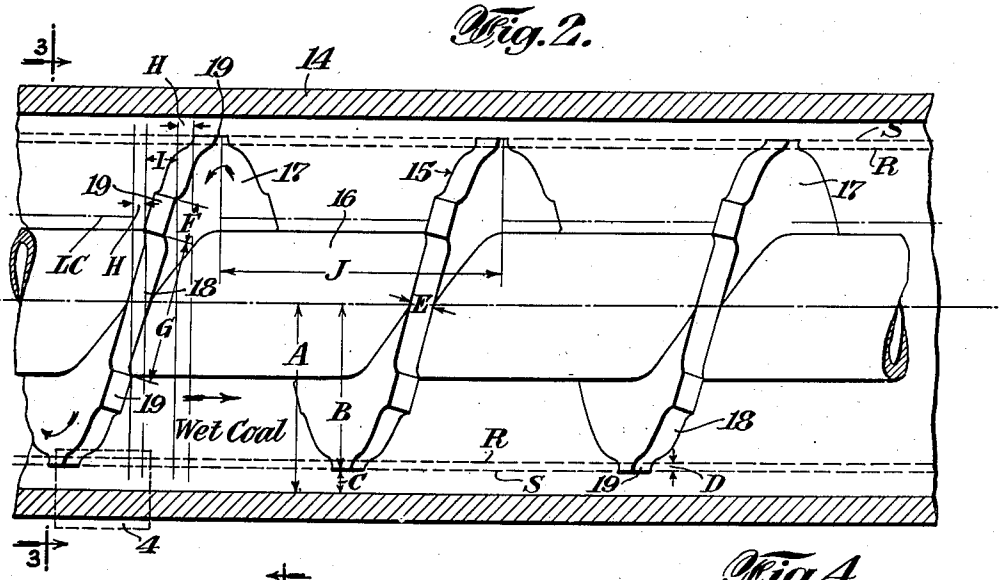


Fig. 3.

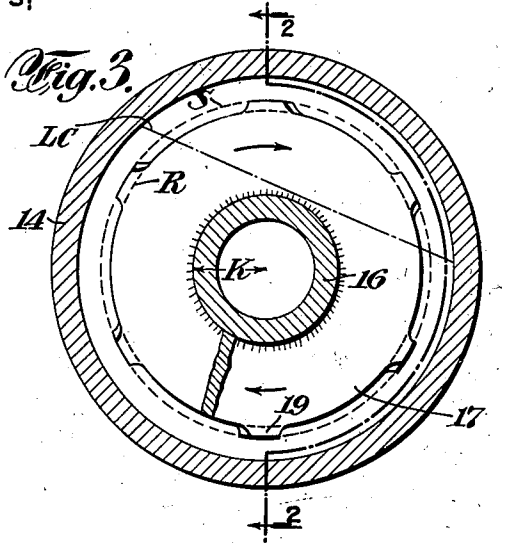
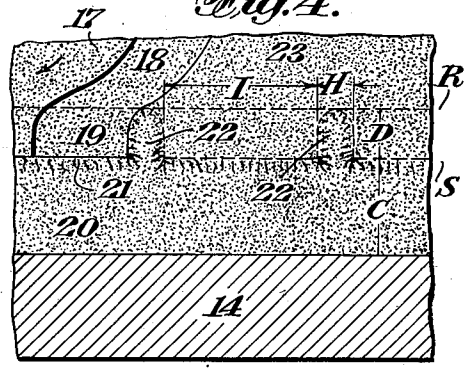


Fig. 4.



INVENTOR
William M. Schweickart
BY
Edwards, Bower & Pool
ATTORNEYS

Dec. 1, 1942. W. M. SCHWEICKART 2,303,584

SCREW CONVEYER

Filed May 16, 1940 2 Sheets-Sheet 2

Fig. 8.

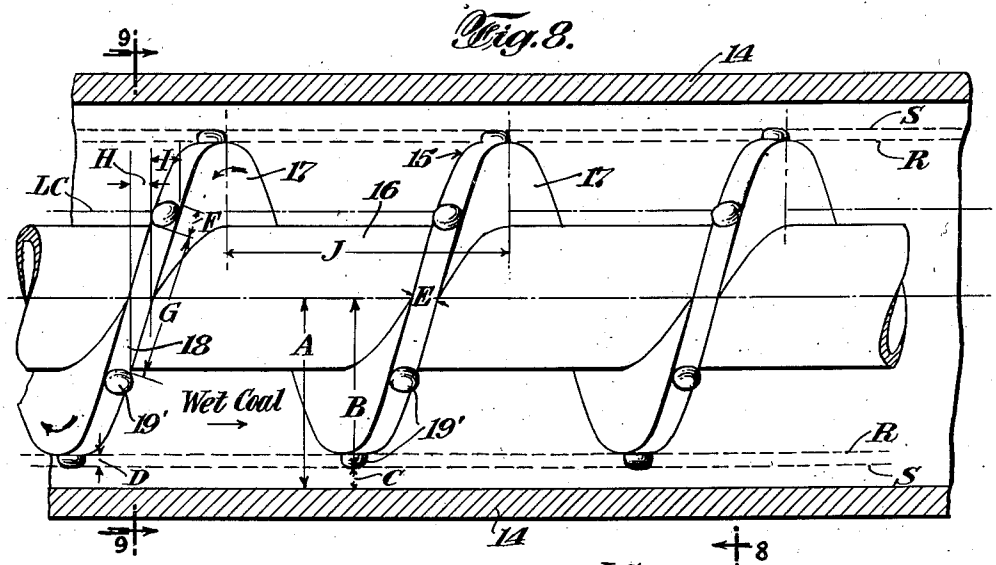


Fig. 5A.

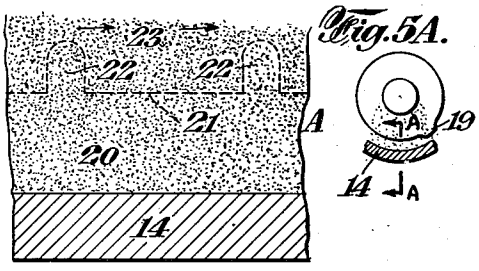


Fig. 5B.

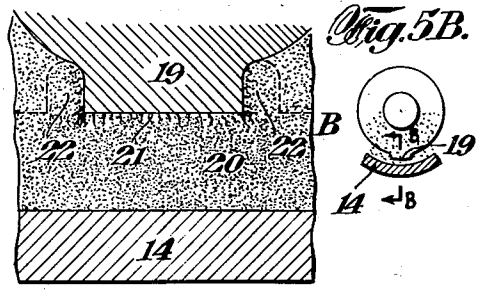


Fig. 5C.

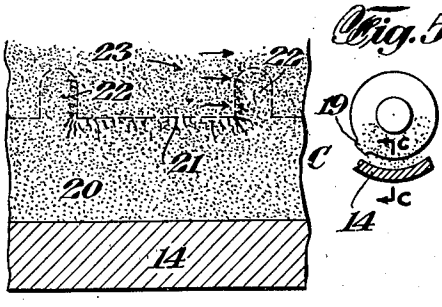


Fig. 9.

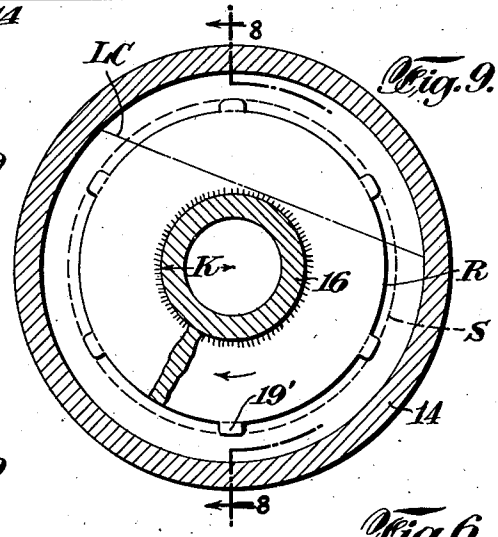


Fig. 6.

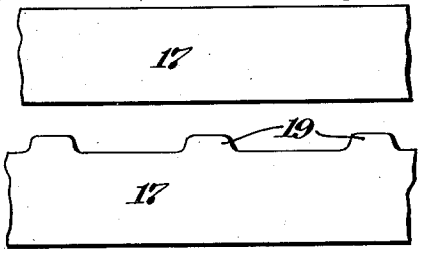


Fig. 7.

INVENTOR
William M. Schweickart
BY
Edwards, Bower & Pool
ATTORNEYS

Patented Dec. 1, 1942

2,303,584

UNITED STATES PATENT OFFICE

2,303,584

SCREW CONVEYER

William M. Schweickart, Euclid, Ohio, assignor to Pocohontas Fuel Company Incorporated, New York, N. Y., a corporation of Virginia

Application May 16, 1940, Serial No. 335,564

1 Claim. (Cl. 198—213)

This invention relates to the feeding of fine granulated material such as coal slack and particularly to the feeding of such material by a screw conveyer within a tube.

The object of the invention is to provide a screw feed which will be efficient in action and avoid any jamming of the conveyer flight within the feed tube due to the accumulation and packing of material between the tube and the screw, particularly when the material is wet.

In the accompanying drawings illustrating apparatus adapted to practice the invention,

Fig. 1 is a diagrammatic view of a stoker installation embodying the invention;

Fig. 2 is an enlarged longitudinal section of a portion of the coal conveyer thereof along its axis, taken as indicated by the line 2—2 of Fig. 3;

Fig. 3 is a vertical sectional view taken along the line 3—3 of Fig. 2;

Fig. 4 is an enlarged view of a portion of the conveyer of Fig. 2, as indicated therein, with portions shown diagrammatically to assist the description of the invention;

Figs. 5A, 5B and 5C are diagrammatic sketches to assist the description of the invention;

Figs. 6 and 7 show the blade of the conveyer screw in certain of its stages of manufacture;

Fig. 8 is an enlarged vertical section of a modified form of coal conveyer; and

Fig. 9 is a vertical sectional view taken along the line 9—9 of Fig. 8.

Referring to Fig. 1, the furnace 10 is equipped with an automatic coal burner or stoker 11 having a driving motor and other equipment within a housing 12. The stoker is of the bin feed type, that is, the stoker automaticaly conveys the coal from the bin 13 into the furnace 10, where the stoker feeds the coal to a suitable burner, not shown. The coal conveyer of the stoker includes the coal feed tube 14 and a worm or coal screw 15 positioned within the coal tube 14.

Referring now to Figs. 2 and 3, the coal feed tube 14 is a smooth cylindrical inner surface or bore which is substantially co-axial with the coal screw 15. The coal screw 15 has a core or shaft portion 16 and screw flights or convolutions 17 spirally arranged along the core. Thus, when the screw is rotated, as by the stoker motor, the screw advances the coal along the tube 14 from the bin 13 into the furnace 10.

When the coal conveyer as so far described conveys fine coal, such as bituminous slack, which is wet, there is a tendency, as the screw rotates, for coal to accumulate and pack on the interior surface of the coal tube and to build up to such height as to impede the rotation of the screw and overload the motor. Under the action of the screw the moisture tends to cement the fine particles of coal together into a hard coating upon the interior of the coal tube, thus decreasing the effective diameter of the tube so that the hard coating in time engages the edge of the screw and very substantially increases the torque required to rotate the screw. Such building up of a hard layer of coal sometimes progresses to the point of seizing the screw and stopping the feed altogether. This tendency for coal to pack and form a hard layer upon the inside of the tube is more pronounced, and the possibility of motor overload and screw seizure more likely, with increasing amounts of moisture contained in the coal. It has been found that fine bituminous coal with a moisture content of about 7% and over has a very marked tendency to pack.

According to this invention the wet coal tending to form into a layer or coating upon the inner surface of the tube is subjected to a grooving action generally transverse to the direction of travel of the coal and the grooved surface is then exposed to the pressure and wearing action of the coal as it moves along the tube. This grooving action tends to disturb and break up any formative layer of coal which may tend to build up, and the subsequent action of the traveling coal upon the disturbed and weakened layer further tends to disperse and remove it. The grooving action takes place along the coal tube with the spaces between successive grooves sufficiently small to insure adequate dispersion of the intervening material between the grooves. Any accumulated layer of coal on the inner surface of the tube is thus broken down at its inception so that objectionable packing is prevented and overloads and screw seizures overcome.

The grooving is effected by a series of projections 19 provided along the edge 18 of the screw blade 17, the projections extending outwardly in continuation of the screw blade. The projections are of substantial height, such as D, in comparison to the clearance (C plus D) between the inside surface of the coal tube 14 and the edge 18 of the coal screw at the base of the projections 19. The projections have substantially the same width as the thickness E, of the screw blade 17, and are of relatively small length, F, in comparison to the spacing G, between successive projections, both measured along the edge of the screw blade, so that the axial distance, H, between the paths described by successive projections is small in comparison to the axial length, I, of the projections 19.

For clarity, only the top level of the coal is shown in Figs. 2 and 3, this level being indicated by the dot-and-dash lines LC, the level LC shown in Fig. 2 being the average level, or that directly above the axis of the screw. The dotted line R indicates the loci of the edge of the coal screw 18 at the base of projections 19, and the

dotted line S indicates the loci of the tips of the coal screw projections 19.

The action of the apparatus is explained by reference to Figs. 4 and 5A, 5B and 5C. It is to be understood that these illustrations are only diagrammatic and indicative of the action which is taking place.

In Figs. 4 and 5B the main current of coal is indicated at 23 and the outer body of coal, here the portion adjacent the bottom of the coal tube 14, is indicated at 20. When the coal is wet, there is a tendency for the outer body of coal 20 to pack and form a hard layer or coating which gradually encroaches upon the coal screw.

A projection 19 is shown scoring into and grooving the outer body of coal 20. This action not only tends to form a groove or valley 21 in the coal between crests 22, but also to disturb and agitate the coal in the vicinity of the groove and crests and to produce cracks therein, thus weakening this body of coal.

When the rotation of the screw carries projection 19 beyond the area under consideration (as shown in Fig. 5C) the groove 21 is first filled by an inrush of coal from the main current of coal 23, this inrush tending to disintegrate the already weakened groove formation. Then the coal in the groove, being subjected to at least some of the motion-producing pressure to which the main current of coal 23 is subjected, bears against the far crest 22 of the groove and this pressure further tends to disintegrate the same. The movement of the main current of coal 23 relative to the outer body of coal 20 also tends to disintegrate the latter. Finally, as the projection 19 again approaches the area under consideration, the coal in the groove in advance of the projection is subjected to pressure and also displaced, and this pressure upon, and motion of, the coal in the groove likewise tends to disintegrate the groove formation.

As between successive grooves, the axial distance H therebetween is such that the crest 22 between the grooves is relatively weak, this weakness being aided by the cracks produced at opposite sides and bases of the crest, some of which cracks tend to meet. Furthermore, the width H of the crest is such in comparison to the axial spacing I between crests and the height D of the crest is such in relation to the width of and spacing between crests, that the main current of coal 23 is able to obtain a relatively effective purchase upon the crest 22 and thereby accelerate its disintegration.

As a result, any tendency for the outer body of coal 20 to pack and build up into a layer or coating is opposed by the layer-disintegrating process caused by the interaction of the projections 19 and the movement of the coal. Furthermore, as the formative layer advances in its formation to a harder and harder consistency, the cracks therein caused by the projection 19 become longer and more numerous with the result that the nearer the outer body of coal 20 becomes to a hard layer the more rapidly it is disintegrated. In this manner the layer of coal on the coal tube is thus destroyed while it is forming, so that the layer of coal is prevented from forming, or at least is maintained at such a low height as to be unobjectionable.

In addition, the projections 19 tend to reduce the friction between the screw and the outer body of coal 20, for only the projections, and not the entire edge of the screw blade engage the portion of such body tending to form into a layer.

The projections 19 in the apparatus of Figs. 2 and 3 are substantially rectangular flat-topped lobes on the edge of the screw blade and integral therewith. These projections are formed along the edge of flat ribbon stock by the use of suitable rolling operations, the stock before such rolling being as shown in Fig. 6 and the stock after such rolling being as shown in Fig. 7. The ribbon stock is then wound around the shaft 16 to form a helix thereon and then secured thereto as by welding, to form the complete coal screw 15.

Figs. 8 and 9 show a modified apparatus in which the projections 19 are spots or drops of metal applied to or deposited upon the edge of the screw blade by welding. The projections 19 in this modification are substantially disc shaped with a dome-like tip surface.

As examples of conveyers embodying this invention the following details of conveyers according to Figs. 2 and 3 and Figs. 8 and 9 are given:

	Figs. 2, 3	*Fig. 8, 9*
A Inside radius of coal tube	1½ inches	1½ inches
B Radius of coal screw to tips of projections	1–$\frac{5}{16}$ inches	1–⅜ inches
C Clearance between inside surface of coal tube and tips of the projections	$\frac{3}{8}$ inch	⅛ inch
D Height of projections	$\frac{3}{32}$ inch	$\frac{3}{32}$ inch
E Thicknss of screw blade	$\frac{1}{16}$ inch	$\frac{1}{16}$ inch
F Length of projections, along edge of screw	¼ inch	$\frac{3}{16}$ to ¼ inch
G Space between successive projections, along edge of screw	1 inch	1–⅛ inch (av.)
H Axial distance between the paths described by successive projections	$\frac{1}{16}$ inch	$\frac{3}{32}$ inch (av.)
I Axial length of projections	$\frac{5}{16}$ inch	$\frac{3}{16}$ to ¼ inch
J Pitch of screw blade	2¼ inches	2–$\frac{5}{8}$ inches
K Radius of screw shaft	$\frac{5}{16}$ inch	$\frac{5}{16}$ inch

The foregoing conveyers have been especially effective in preventing jamming of coal screws handling bituminous coal on the order of one-eight and one-quarter inch slack.

While the screw conveyer has been shown and described in connection with a bin feed type of stoker, it is equally applicable to other coal feeds.

I claim:

A conveyer adapted to convey fine particles of moisture-laden bituminous coal comprising a substantially horizontal coal tube having a substantially cylindrical inner surface, a coal screw positioned within the coal tube and having a predetermined loose clearance between the outer edge of the helical screw blade and the inner surface of the coal tube, a series of small radial projections on the periphery of the coal screw blade of a height substantially less than said clearance and having a peripheral coverage which is a relatively small proportion of the total periphery of the edge of the screw blade and spaced apart so that as the coal is conveyed horizontally by said blade said projections will cut into any layer developing within said clearance space and form a series of grooves in said layer with separating ridges having greater radial height than axial width and protruding into the path of the conveyed coal so as to break up the coating and disperse the accumulating layer and remove it without substantial increase in the torque on the coal screw.

WILLIAM M. SCHWEICKART.

CERTIFICATE OF CORRECTION.

Patent No. 2,303,584. December 1, 1942.

WILLIAM M. SCHWEICKART.

It is hereby certified that error appears in the above numbered patent requiring correction as follows: In the grant, lines 2 and 13, and in the heading to the printed specification, line 4, name of assignee, for "Pocohontas" read --Pocahontas--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 12th day of January, A. D. 1943.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)