

No. 629,596.

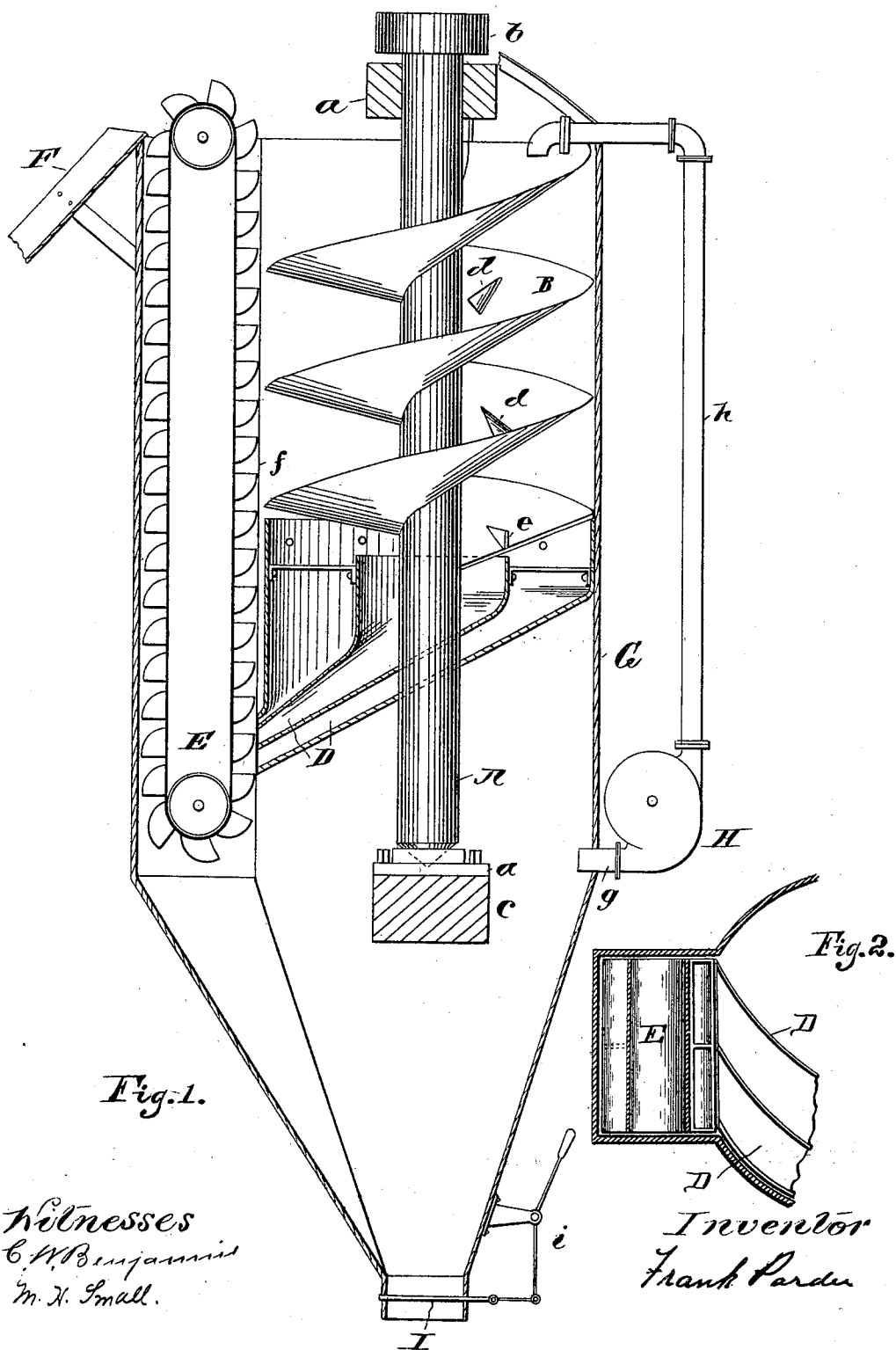
Patented July 25, 1899.

F. PARDEE.

SEPARATOR FOR ORE, COAL, &c.

(Application filed Nov. 18, 1898.)

(No Model.)



UNITED STATES PATENT OFFICE.

FRANK PARDEE, OF HAZLETON, PENNSYLVANIA.

SÉPARATOR FOR ORE, COAL, &c.

SPECIFICATION forming part of Letters Patent No. 629,596, dated July 25, 1899.

Application filed November 18, 1898. Serial No. 696,766. (No model.)

To all whom it may concern:

Be it known that I, FRANK PARDEE, a citizen of the United States, and a resident of Hazleton, in the county of Luzerne and State of Pennsylvania, have invented certain new and useful Improvements in Separators for Ore, Coal, &c., of which the following is a specification.

My invention relates to separators for ore, coal, &c., which operate by centrifugal force, so as to cause a separation of the substances by virtue of the same and of their difference in specific gravity or frictional resistance.

The principal objects are, first, to provide a machine having the special advantages of a rotary movement of the spirals along or through which the substances pass; secondly, to provide means by which advantage may be taken of the action of water thereon, and, thirdly, to make provision for receiving the separated substances and for conveying them out of or from the machine.

When coal is taken from the mines, it is mixed with more or less rocky substances, usually designated as "slate," which contain silica or other gritty matter possessing a peculiar frictional resistance when moving over other solid substances. This resistance is such during the passage of the mixed substances along the spirals of a centrifugal separator as to cause the slate to move slower than the pure coal or that which contains thin layers of slate and known as "bone." The centrifugal action causes the coal to glide with more rapidity, and as it meets with less resistance from the surface over which the several substances are made to travel it passes to the outer edge of the spirals, the bone being next and the slate nearest the center. The difference in the nature and action of the substances makes centrifugal action available for purposes of separating substances of different specific gravity and frictional resistance, though it is not wholly to be relied upon, nor should the centrifugal motion be so rapid as to overcome the resistance which can be made to operate against the speed of the slate and bone when moving over another solid surface. Under these conditions the resistance can be taken advantage of by mechanical means for changing the course of the substances possessing such property for

causing them to proceed nearer the center of a spiral way and come within the proper limits before emerging from the machine. If to such action there be added a flow of water for washing the materials on the spirals and floating the lighter particles, still better results may in many instances be obtained.

To attain the objects stated, the invention consists of a separator comprising a rotary spiral way for causing the separation or assortment of different substances and means for receiving the same as they emerge separately from the spirals thereof, as well as in the combination with means for conveying them from the machine; also, in having water connection, and in the constructions, arrangements, and combinations, as hereinafter more fully described, and pointed out or indicated by the claims hereof.

In the drawings, Figure 1 is an elevation, partly in section, of a separator embodying in a single machine one form of the several features of the invention as designed for the separation of coal from slate, in which combination it will be described, though applicable to the separation of other substances. Fig. 2 is a fragmentary section showing the discharge-chutes in relation to the conveyer. The machine thus shown is of the vertical type, which for the use stated is the preferable form.

In the drawings, A represents a shaft around and along which a spiral way B is constructed, so as to form a floor along which the substances pass. This floor may have an incline or pitch toward the shaft or axis and toward the outlet for the separated substances, so as to aid precipitation of the substances having greater weight or frictional resistance toward the center and to assist all of the substances being acted upon in their passage through the machine. The shaft of the spiral is suitably journaled at or near each end to the blocks *a a* and may be provided with a pulley *b* or other means for receiving power connections. The journals *a a* are suitably supported by connections, (not shown,) the lower journal being on a beam *c*, the details of such connections or the manner of forming the journals being immaterial.

The drawings show a single spiral way B; but, if desired, there may be two or more, and

the spiral is shown as being provided with undulating surfaces in the form of humps or non-continuous ridges *d d*, which aid in turning certain substances inward when their tendency might be to go too far outward. These undulating surfaces may be of any form and continuous or non-continuous, as desired.

When the machine is constructed with a single spiral or when it is desired to take advantage of the separation made on one spiral, some means ought to be provided for keeping the assorted substances apart as they emerge therefrom, and this may be accomplished in various ways. The drawings show a short stationary partition *e*, which acts as a guide at the outlet of the spiral; but an adjustable pivot-gate or any other suitable means may be employed for the purpose.

In order to receive the separated substances emerging from or passing off of the rotating spiral, provision is made for permitting a continuous discharge by having circular chutes or receptacles *D D*, corresponding, approximately, in diameter to the portion of the spiral occupied or taken up by these several substances or as guided by the partition *e* or whatever means may be employed for directing them therefrom. The circular chutes *D D* are shown as leading to a conveyer *E*, having divided buckets or pockets for keeping them apart during their elevation or passage from the machine and, as shown, delivery to a double or divided chute *F*, which carries them to any desired place. The elevator or conveyer *E* may of course be dispensed with in certain cases and especially when the separator is not inclosed within a water-tank or the circular chutes *D D* lead to receptacles for receiving and holding the separated substances until it is necessary or desirable to remove them. In the drawings, however, a tank *G* is shown as inclosing the spiral way *B*, which connects by the chutes *D D* with the elevator *E*, which is separated from the body of water by a partition *f*, to which the chutes *D D* are joined at proper openings, through which they lead to the buckets or pockets of the conveyer. The tank *G* is designed to contain a body of water, which may be circulated therein by means of a pump *H*, connected to the interior thereof by a pipe *g* and discharging through a pipe *h*, leading from the pump to the top of the tank, as shown. By such means a circulation may be maintained in the tank, so as to use the same body of water over and over without waste; but where the supply of water is such as not to be an object in the economic operation of the machine a continuous flow to and from the machine may be maintained by any suitable pump or other connections without the necessity of a containing-tank. The lower part of the tank *G* is shown as extending some distance below the outlet of the spiral way and of the chutes leading therefrom, and in such case it is provided, preferably at the bottom, with an outlet and

a gate *I*, having lever connections *i*, so that it may be emptied and washed out whenever desired.

The operation is as follows: The tank being filled with water, the pump set in operation to keep it in circulation, and the spiral rotated by connections with power, the mixed substances—say coal and slate—are admitted at the top of the spirals. The current of the water will follow the course of the spirals, carrying with it the substances to be separated, which, with the centrifugal action produced by the form and the rotation of the spirals, causes the mixed substances to whirl rapidly around and along the same, and during their passage over and along the spirals the lighter substances or those having less frictional resistance will be carried to the outer portion of the way, while those having greater weight or frictional resistance will move to the center or inner part. The separated substances pass off at the outlet of the spirals into the circular chutes leading to the conveyer, which, being in operation, will carry them up and out of the machine, discharging them into the chutes leading therefrom.

Though the several features of the invention as I intend to claim it are shown and described as being embodied and combined in a single machine, it will of course be understood that as pointed out or indicated by the claims certain features may be used in other relations or combinations which do not embody the details of construction as shown or as hereinbefore set forth in connection with the drawings.

I do not herein claim the features of construction of spiral separators which are the subject-matter of the application filed by me on May 17, 1898, Serial No. 680,987, nor do I herein claim the features of such a machine which form the subjects-matter of the several applications filed by me on November 18, 1898, Serial Nos. 696,761, 696,762, 696,763, 696,764, 696,765, and 696,767, respectively, to which reference is hereby made.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A machine for separating ore, coal, &c., comprising a rotary shaft, a spiral way formed around and along said shaft, constituting a floor provided with an incline the plane of which pitches toward the center and toward the outlet for separating different substances, and circular chutes at the outlet of said way for receiving the separated substances.

2. A machine for separating ore, coal, &c., comprising a rotary shaft, a spiral way formed around and along said shaft, constituting a floor provided with an incline the plane of which pitches toward the center and toward the outlet, means for causing the substances acted upon to emerge separately from said way, and circular chutes at the outlet thereof for receiving the separated substances.

3. A machine for separating ore, coal, &c.,

comprising a shaft a rotary spiral way formed around and along said shaft, means for causing the substances acted upon to emerge separately from said way, and circular chutes at the end thereof for receiving the separated substances, in combination with a partitioned conveyer for receiving the separated substances from said chutes.

4. A machine for separating ore, coal, &c., comprising a shaft a rotary spiral way formed around and along said shaft, and circular chutes at the end of said way, in combination with means for causing a flow of water along the spirals of said way.

5. A machine for separating ore, coal, &c., comprising a shaft a rotary spiral way formed around and along said shaft, means for causing the substances acted upon to emerge separately from said way, and circular chutes at the end thereof, for receiving the separated substances, in combination with means for causing a flow of water to said way.

6. A machine for separating ore, coal, &c., comprising a shaft a rotary spiral way formed around and along said shaft, means for causing the substances acted upon to emerge separately from said way and circular chutes at the end thereof, in combination with means for causing a flow of water to said way and a conveyer for taking the separated substances from the machine.

FRANK PARDEE.

Witnesses:

A. M. EBY,

GUST. FISCHER.