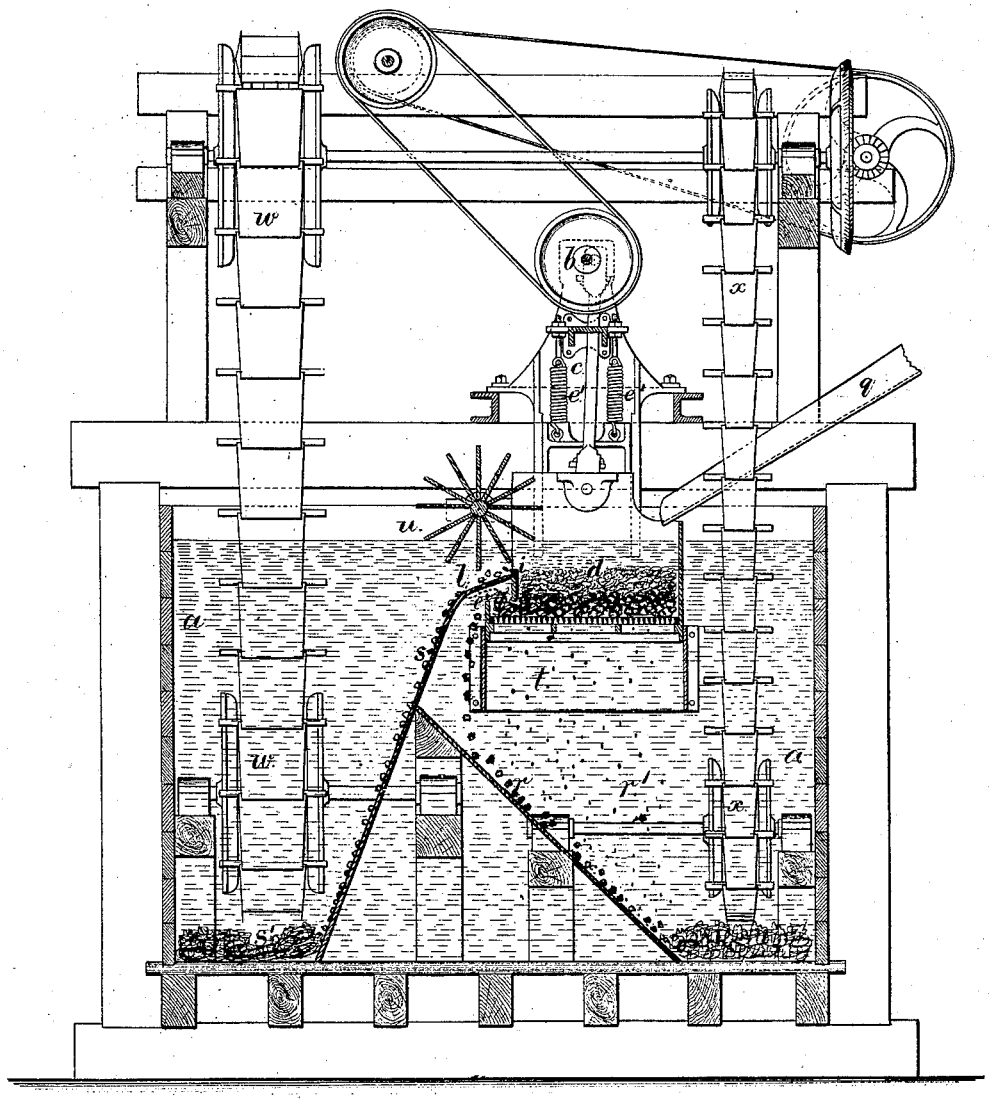
2 Sheets--Sheet 1.

H. BRADFORD.

Separating Coal from Slate, &c.

No. 166,252. Patented Aug. 3, 1875.

Fig. 1.



Witnesses.

Chas. H. Smith

Geo. S. Pinckney

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Hezekiah Bradford

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2 Sheets--Sheet 2.

H. BRADFORD.

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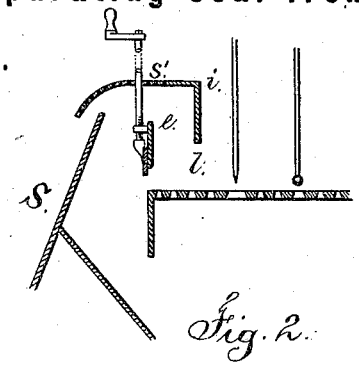
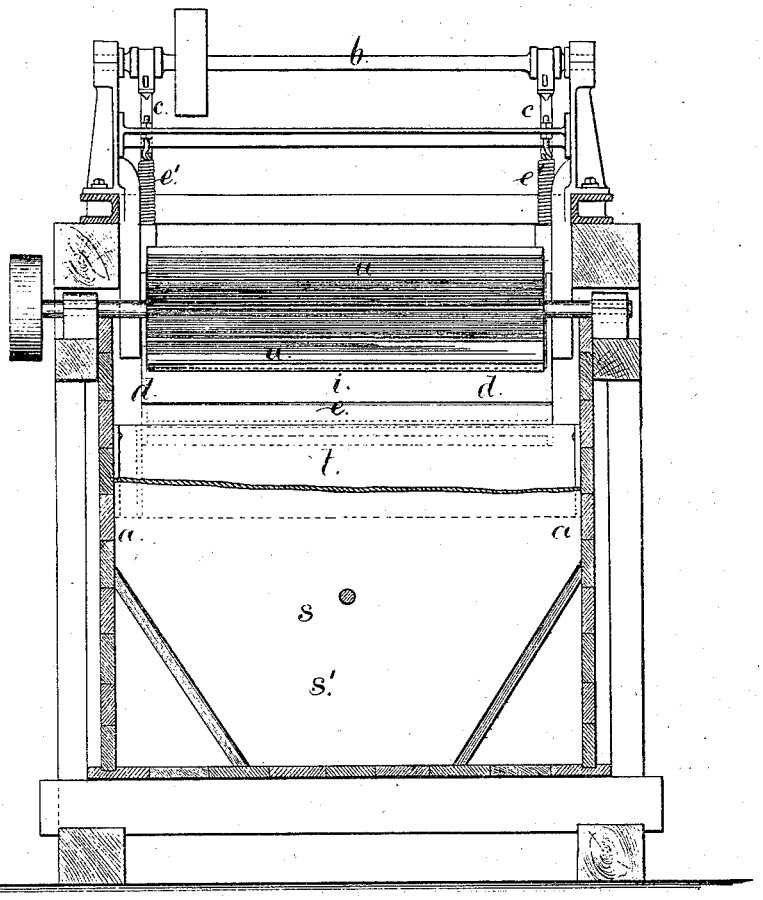


Fig. 3.

Fig. 2.



Witnesses.

Chas. H. Smith

Geo. S. Pinckney

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UNITED STATES PATENT OFFICE.

HEZEKIAH BRADFORD, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN SEPARATING COAL FROM SLATE, &c.

Specification forming part of Letters Patent No. **166,252**, dated August 3, 1875; application filed October 3, 1874.

To all whom it may concern:

Be it known that I, HEZEKIAH BRADFORD, of Philadelphia, in the State of Pennsylvania, have invented an Improvement in Separating Anthracite Coal from Slate or other substances, or separating other substances of different specific gravities, of which the following is a correct specification:

In Letters Patent heretofore granted to me a jig or vertical reciprocating box is shown, with perforations in the bottom of the jig-box of larger size than the pieces of material to be separated, and upon which valves are supplied that are larger than the holes, and of a gravity heavier than the lightest material and lighter than the heaviest material, so that when the jig is reciprocated in the water the heavy pieces of the substances to be separated will pass down through the perforated bottom, and the lighter ones remain on top and pass over one or more edges of the jig-box.

In my present invention the materials are separated according to their relative specific gravity, but the valves are not specifically and separately supplied, but are collected from the unseparated coal by the machine itself, which is so adjusted as to automatically retain a layer of valves of any desired thickness from the material as it is passing through the machine, producing a more regular and perfect separation of the slate and bone-coal from the coal, and causing the machine to be self-regulating, and dispensing with the constant attention and judgment of the operator, heretofore generally necessary with this class of machines.

In assorting coal into different sizes screens are used, the meshes corresponding with the size selected. I make the meshes of the grate in the bottom of the jig sufficiently smaller than the screen through which the unseparated coal is supplied to the jig, so as to be sure at all times to collect in the jig a little more than sufficient slate and bone-coal to act as a layer of valves, while any surplus of slate or bone-coal so collected passes off automatically at a lower point of the jig-box than the point of delivery of the coal, and any pieces of slate or bone-coal that are sufficiently small to pass down through the grate in the jig-box are delivered in that manner, the same as set forth in patents heretofore granted to me.

Separating-machines operated by plungers and without valves have been made, in which the lighter materials flow off from near the surface of the water, and the heavier materials have been discharged periodically, or at the discretion of the operator. In all of these separating devices there is in practice a risk of the supply being irregular, or stopping, or that the percentage of slate and bone-coal may vary, and hence the lighter materials will frequently be delivered with the heavier substances and the separator will cease to act correctly, or else the materials will entirely discharge themselves at the lower delivery.

My improvement prevents these difficulties. It is well known that coal, ore, and other substances, when agitated in water by the movement of the jig-box, are in a condition that will cause the particles to assume a level proportioned to gravity.

I avail of this property in the materials under treatment to determine the points of continuous delivery of materials of different gravities, and make the line of delivery of the lighter material higher than the line of delivery of the heavier material, and so proportioned that the short column in the water of the heavier material equals in weight the higher column of lighter material; hence, these will only flow over the delivery-edges in consequence of an accumulation in the jig-box, and when the supply is arrested the delivery stops, or very soon thereafter, leaving in the jig-box the materials that are necessary for correctly commencing operation when the feed is renewed.

In the drawing, Figure 1 is a vertical section of the jig complete; and Fig. 2 is a side view of the jig, and a section of the tank containing water.

The tank *a* is of suitable size, and the water therein is kept to about a uniform level and depth, as set forth in my former patent; and *b* is a shaft, revolved by competent power, and provided with cranks acting upon connecting-rods *c*, to give a vertical reciprocating movement to the jig-box *d*.

The springs *e'* serve to sustain the weight of

the jig and its contents in the water, and equalize the strain upon the cranks and moving parts, and the extent of movement and the rapidity of operation will be proportionate to the size of materials operated upon; and the general remarks upon this subject in the former patents that have been granted to me will serve as a guide in adapting this machine to different sizes or characters of material, except in the points hereafter set forth.

The grate or bottom of the jig should be as full of holes as possible, and be made with meshes or openings smaller than the larger portion of the materials to be jigged, so as to collect within the jig a small surplus of the materials that serve as valves, and the coal will be delivered over the discharge edge *i*, and the surplus valves collected in the jig—viz., the slate and bone-coal—will be delivered over the edge *e*, and the smaller pieces of slate, bone-coal, and heavy particles will pass down through the valves and grate.

The portions of the jig at *i* and *e* form dams to retain the proper amount of material, and only the surplus is delivered over the edges of these dams, according to gravity.

The coal or other material reaches the jig by the incline *q*, to which it is supplied by a suitable feeder in a regulated quantity; and the jigging operation in the water will loosen up the mass, and cause the particles to assume their relative positions according to gravity, the heaviest portions being at the perforated bottom, and the lightest at the top. This result is attained by the jigging motion, producing an upward action by the water to lift the coal or other materials of lighter gravity, and keep them at the top, so that they do not pass through the valves, nor out with the slate or heavier particles at the lower opening, but pass, as they accumulate, over the edge *i*.

The perforated inclines *r* and *s* serve to separate the tank or vat into two receptacles, the one at *r'* receiving the slate or heavier particles, the other at *s'* receiving the coal or lighter pieces of material.

It is preferable to employ a rigid stationary box, *t*, below the grate to confine a sufficient body of water to render it more effective, by its inertia, in its operation upon the contents of the jig; and the jig-box itself should extend below the grate sufficiently to confine the water and prevent any eddy or false currents, and to render the upward current uniform at the sides as well as the middle of the jig.

The coal or lighter material passes over the edge *i* to the incline *s*, and is removed therefrom as in my former patents; but at this point I sometimes use the wheel *u*, that is made with paddles, that are, by preference, either hinged or made flexible, so as not to injure the pieces of coal or other material that passes from the jig upon this incline; but such wheel moves the coal or light material along and down such incline, as well as acting to draw the water from the jig-box and elevate it slightly in the tank or vat, the object of this being to maintain the level of the water in the tank a little higher than in the jig-box, thereby causing a greater upward flow of the water through the jig-box, to render the separation, in some instances, more perfect. This object may be accomplished by a wheel, pump, or other means.

From the foregoing the mechanism for assorting the coal or other materials, according to gravity, will be understood, and also the manner in which the coal or lightest portions will be delivered from the jig. I will now proceed to describe the delivery of the slate, bone-coal, or heavier portions.

At *l* is a lateral opening in the side of the jig-box running longitudinally immediately above the perforated bottom of the jig; hence as the jig is reciprocated, the slate, bone-coal, and heavier material will spread or work through this opening *l*. The principal thing to be accomplished is to deliver the pieces of heavier and lighter material at the proper relative speed, while the supply continues, and to arrest the delivery when the supply stops. When the jigging operation is commenced, and the supply continues, the materials accumulate, and the lighter materials reach the level of the delivery edge *i* of the higher dam, and the heavier materials fill up to the delivery edge *e* of the lower dam.

It will now be apparent that there is a balance arrived at between the materials in the mass subjected to the jigging operation, the higher column of lighter material to the edge *i* equaling the less column of heavier material to the edge *e;* hence if the jigging motion is continued, though the supply of materials may temporarily cease, little will escape over either edge until the mass is increased by the renewed supply of material passing into the jig, and the delivery will take place simultaneously of the lighter material over the edge *i* and the heavier over the edge *e*, and this operation will proceed continuously while the supply lasts, and stop when the supply is cut off, or nearly so.

If this improvement is employed with materials of equal or nearly equal size, and of different gravities in regular or defined proportion, then the jig may be constructed with reference thereto, and the parts will not require adjustment; but it will usually be necessary to construct the parts adjustably, so that the width of opening at *l* shall be made sufficient for the largest of the pieces to pass through freely, and the edges *i* and *e* of the respective dams may be raised or lowered by movable pieces or plates, or otherwise, so as to adjust the relative levels of the delivery-edges *e* and *i*, according to the size and gravity of the materials operated upon.

If desired, openings may be made in the jig-bottom, or near the mouth *l*, or through the dam below the edge *e*, to allow the slate and heavier portions to work off through these

openings, and such openings may be provided with gates or valves that are adjustable or raised as the jig descends, as set forth in Letters Patent No. 143,492 granted to me, and as illustrated in Fig. 3. In this case the bone-coal and lighter portions of the slate will accumulate sufficiently to act as valves. These devices increase the space between the incline *s* and the delivery edge *i*, and to allow for this it is preferable to employ the horizontal perforated shelf *s'*, curved at the outer edge, (see Fig. 3,) extending from the delivery edge *i*, and upon this the coal rests and is conveyed away by the flow of water; or the wheel *u* may be applied at this place and serve to carry the coal across this shelf *s'* to the incline *s*.

The wheel *u* may be sustained by and move with the jig, if desired.

In applying the present invention to the separation of bituminous coal and ores, the conditions and mode of use set forth in my Patent No. 143,219 are to be followed.

Of course these operations must be performed with judgment according to the character of the materials operated upon, the general items to be borne in mind being that the width of the opening *l* and height of the lower dam *e* regulate the thickness of the bottom layer of valves, the surplus of which is discharged laterally, and that the width of the opening *l* will also depend upon the size of the materials operated upon, so that they will pass freely, and that the relative quantity of this discharge is increased by lowering the edge *e*, and lessened by raising this edge *e*, relatively to the edge *i*, hence the relative quantity of material discharged over *e* can be increased by raising the edge *i*, or by lowering the edge *e*, and vice versa. As a consequence, the attendant can usually effect the required adjustment by simply raising or lowering the side or edge *i*, but both *i* and *e* may be adjusted, if desired. If this improvement is used with anthracite coal, then the separation can be made at any desired point of gravity, according to the positions of the aforesaid parts, the slate and bone coal or substances heavier than the coal will pass off as waste, and those that are of less gravity than the bone-coal will be delivered over the edge *i*, as the marketable article.

By this construction one jig-box may be adjusted to suit more than one size of coal. The coal is usually assorted into sizes previous to separating the slate, and it is better to have a jig adapted to each size.

It will generally be preferable to employ a jig-box with a level bottom, but for some characters of materials the bottom may be at an inclination downward toward the place of delivery.

If the holes in the jig bottom are small enough to prevent any of the material passing through, then the whole thereof will be delivered over the respective edges *i e*.

I have represented endless chains of elevating-buckets, those at *w* being adapted to removing the coal or lighter material, and those at *x* the slate or heavier material, but a rake may be employed for raising the coal, as shown in Letters Patent No. 143,219, or the slate may be similarly delivered, or either may be delivered in any other convenient method.

I claim as my invention—

A reciprocating jig, substantially as described, having a perforated bottom, and two dams with delivery edges at different elevations for retaining materials that are balanced according to their respective specific gravities, and delivering the surplus automatically and separately according to gravity, as set forth.

Signed by me this 19th day of September, A. D. 1874.

HEZEKIAH BRADFORD.

Witnesses:

GEO. T. PINCKNEY,

LEMUEL W. SERRELL.