Oct. 27, 1931. F. H. BLATCH 1,828,760

APPARATUS FOR WASHING COAL

Filed Dec. 6, 1927 3 Sheets-Sheet 1

Fig. 1.

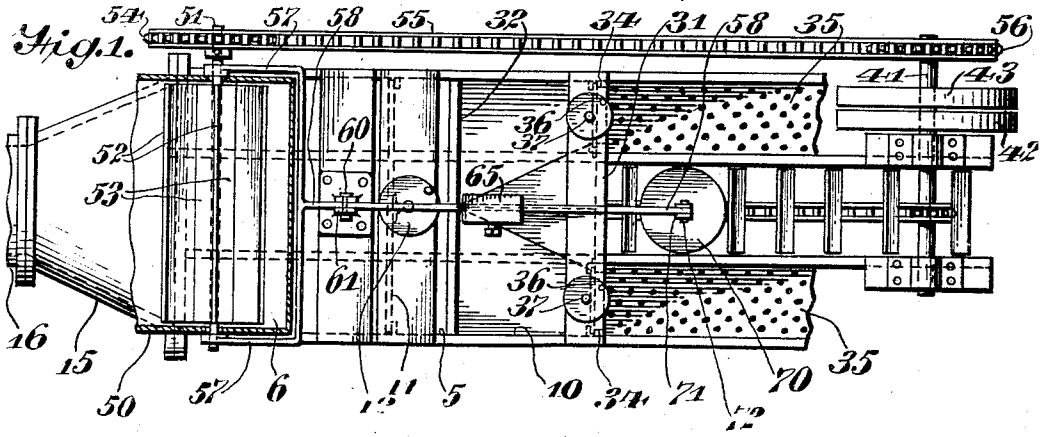
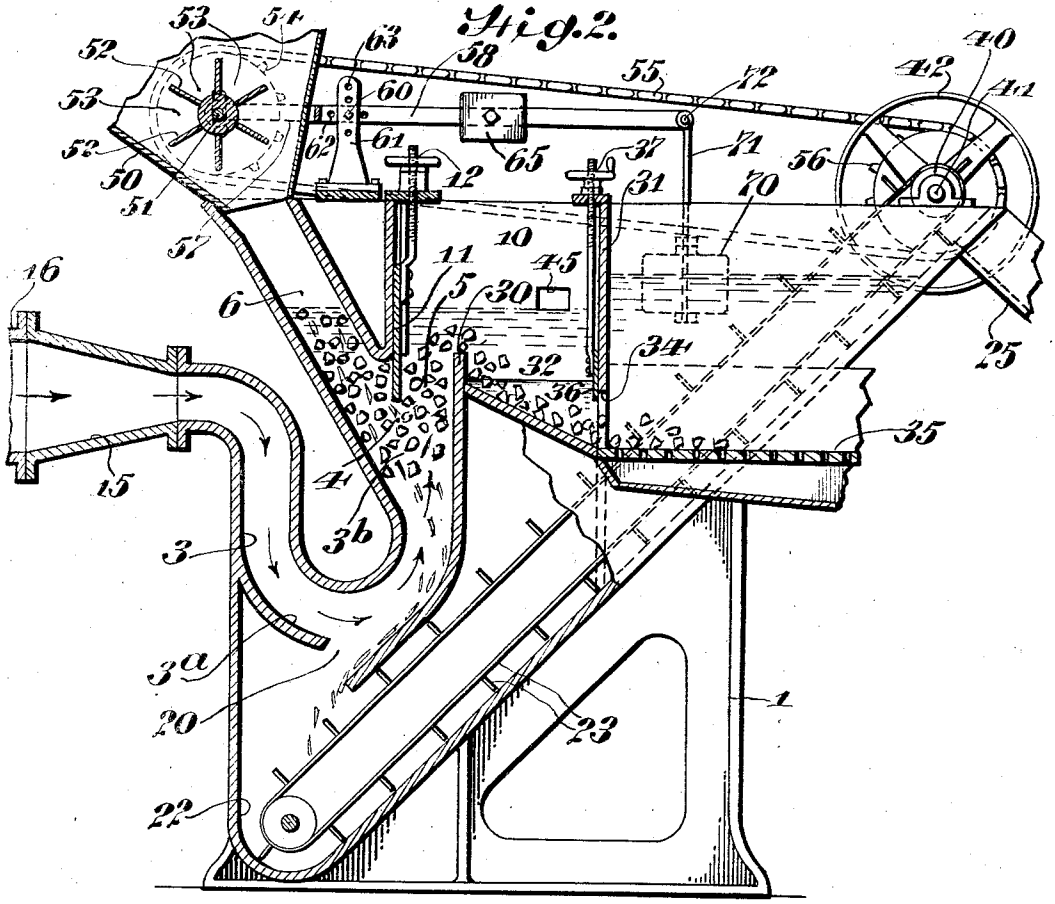


Fig. 2.



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Filed Dec. 6, 1927 3 Sheets-Sheet 2

Fig. 3.

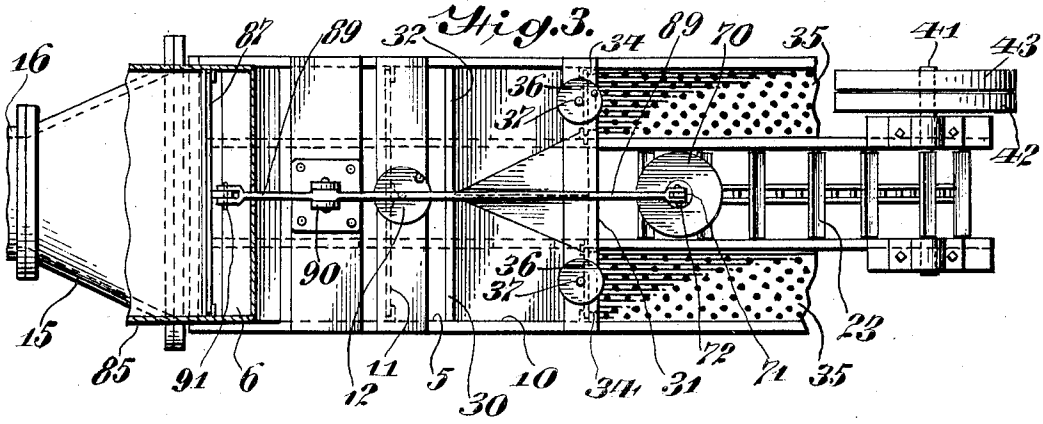
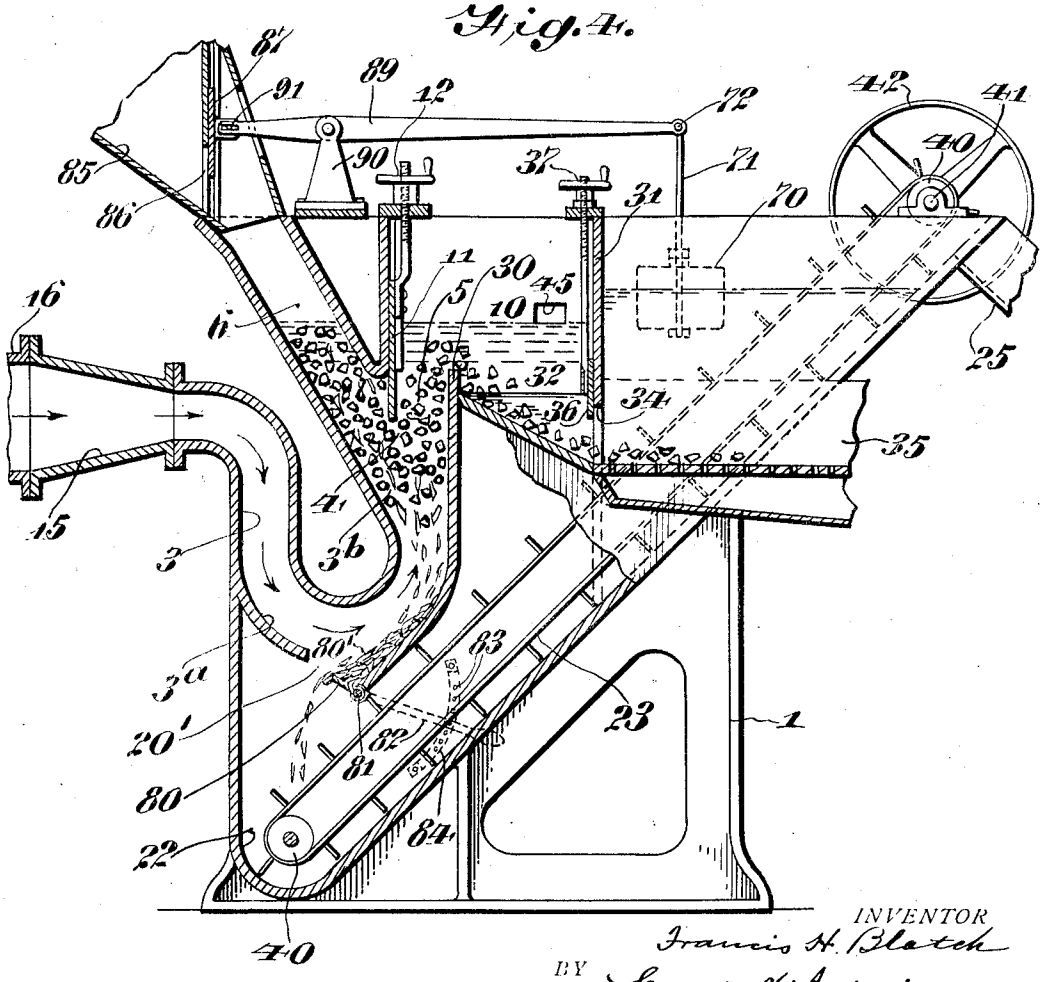


Fig. 4.



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Oct. 27, 1931. F. H. BLATCH 1,828,760

APPARATUS FOR WASHING COAL

Filed Dec. 6, 1927 3 Sheets-Sheet 3

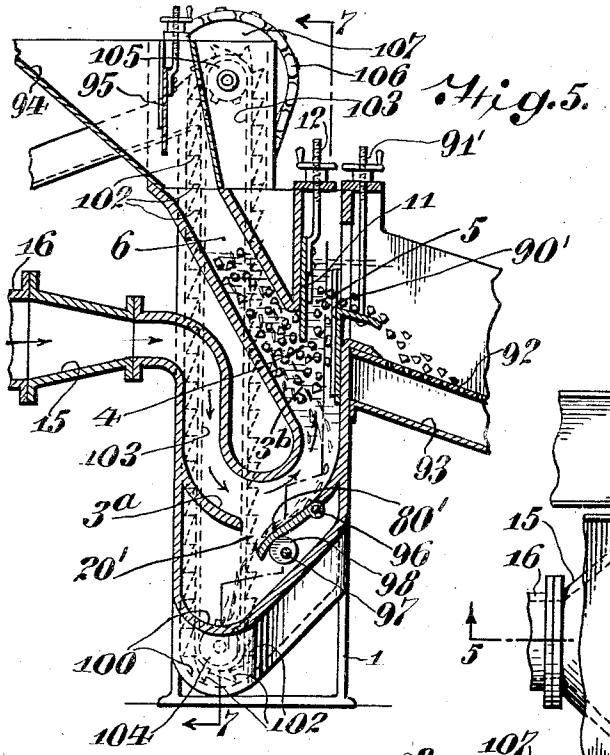


Fig. 5.

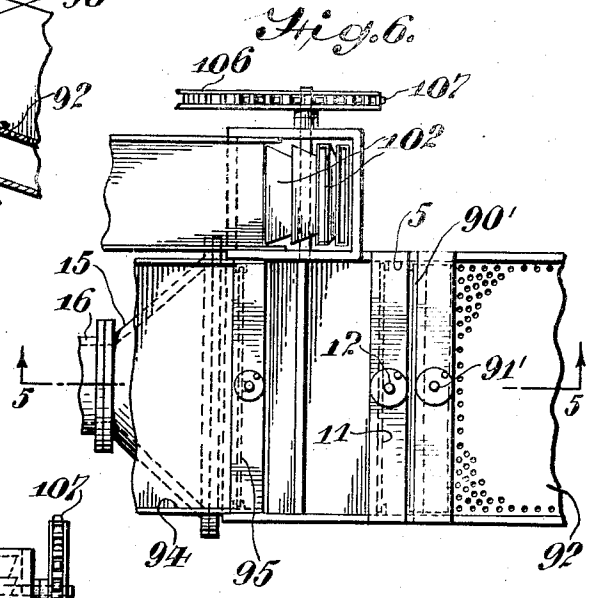


Fig. 6.

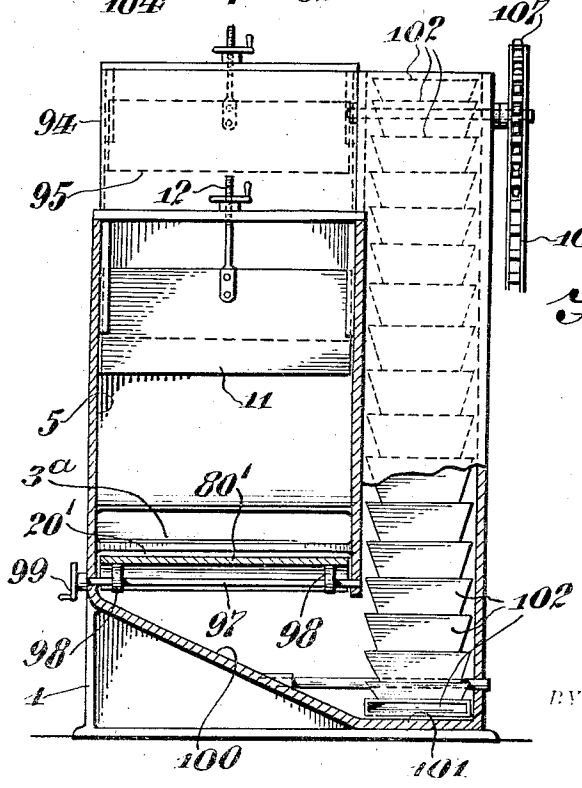


Fig. 7.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR WASHING COAL

Application filed December 6, 1927. Serial No. 238,013.

My invention relates to apparatus for washing coal and separating the same from its impurities of the type in which the washing and separation is effected by the action of a stream of water flowing continuously and under substantially constant pressure through a passageway in a direction opposite that of the movement of a mixture of coal and impurities supplied to such passageway.

In the construction as illustrated the upper end portion of the passageway is divided into two branches through one of which the mixture of coal and impurities is supplied which in its descending movement meets the ascending stream in the region of the passageway at and below the joinder of the said branches. The water in its ascending flow leaves or escapes from the passageway into the main body of the tank through the other of the said branches. The speed of upward or ascending flow of the stream of water should be such as to provide a force sufficient to carry the coal along therewith in an upward direction, but of insufficient force to cause such movement of the impurities, the specific gravity of which is greater than that of the coal.

The general object of the invention is to provide an apparatus of the character indicated of novel but simple construction and which is efficient in operation.

The said invention resides in the novel combination and arrangement of parts as hereinafter described in detail and particularly pointed out in the claims.

In order that the invention may be readily understood, reference should be had to the accompanying drawings in which I have illustrated certain forms of embodiment thereof. However, it will be understood that the invention is susceptible of embodiment in other forms of construction than those shown and that changes in the details of construction may be made within the scope of the claims without departing from the said invention or the principle thereof.

In the drawings:

Fig. 1 is a view in top plan of a construction of apparatus embodying the invention;

Fig. 2 is a view partly in section and partly in elevation taken longitudinally of the said apparatus;

Fig. 3 is a view in top plan showing an apparatus embodying a slightly modified form of the invention;

Fig. 4 is a view in sectional elevation of the structure as shown in Fig. 3 and extending longitudinally thereof;

Fig. 5 is a view in vertical section of an apparatus embodying another modified form of the invention, the said view being taken on the line 5—5 of Fig. 6;

Fig. 6 is a top plan view of the apparatus shown in Fig. 5; and

Fig. 7 is a view in sectional elevation taken on the line 7—7 of Fig. 5.

In the drawings, 1 designates as a whole the pedestal or frame structure by means of which the tank portion of the structure is supported. The tank is divided into various compartments which will be referred to by number as the description of the apparatus proceeds.

For the purpose of supplying water for washing and separating the coal from such impurities as may be intermingled therewith, I have provided a passageway 3 having a downwardly extending curved portion 3^a and an upwardly extending curved portion 3^b as shown in Figs. 2, 4, and 5 of the drawings. The portion 3^b is widened as indicated at 4 and is divided into two branches 5 and 6. Through the former of these branches the coal which is separated from such impurities as may have been intermingled therewith and the water supplied through the said passageway 3 are discharged into the compartment 10 of the tank. The coal is discharged into the upper end of the branch pipe 6 and descends therein and meets the upwardly flowing stream of water within the enlarged portion 4 of the passageway as will be clearly apparent from an inspection of Figs. 2, 4, and 5 of the drawings.

The point of juncture or meeting of the passageways 5 and 6 may be varied by adjusting the plate 11 vertically either up or down by the operation of the adjusting means indicated at 12.

The water is supplied to the passageway

3 from a nozzle 15 which is widened in a horizontal direction and contracted somewhat in a vertical direction as is clearly shown in the drawings. The water is supplied to the nozzle 15 through a pipe 16 having connection with a source of supply, not shown.

The nozzle is shaped as shown and described in order that the water may be supplied to the passageway 3 under uniform pressure so that all portions of the mixture of coal and slate which may be delivered to the enlarged portion 4 at the upper end of the upwardly extending portion of the passageway may be subjected to substantially the same action or pressure.

As indicated the flow of the water should be of a speed sufficient to supply an upwardly acting force necessary to carry the coal upwardly through the branch pipe 5, but not sufficient to cause a like movement of the impurities of the mixture, said impurities consisting of slate, "bony" material, stone or the like. The impurities which descend downwardly through the upwardly extending portion of the passageway escape therefrom through an opening indicated at 20 in Fig. 2 of the drawings and 20′ in Figs. 4 and 5. In the construction as illustrated in Figs. 1 to 4 the impurities after having been discharged from the said opening, 20 or 20′, descend into a pocket 22 and are removed therefrom and from the tank by means of an endless conveyor 23 of usual construction. The said pocket and conveyor are located at the central portion of the apparatus. The impurities are discharged from the conveyor 23 into a chute or trough 25 through which they pass from the apparatus in known manner. The coal which is separated from the impurities is discharged from the branch 5 over the upper edge of a wall 30 which constitutes the front side of the upwardly extending portion of the passageway. The upper end portion of the said wall co-operates with a transversely extending wall 31 to form a compartment 32 into which the coal is discharged and from which it leaves the tank through openings 34 provided at the opposite sides of the apparatus. The coal travels forward in troughs 35 provided upon opposite sides of the pocket or compartment within which the conveyor 23 is located. These troughs are perforated to permit the escape of the water from the coal. The water which thus escapes is caught in troughs or the like and discharged at any desired point. The sizes of the openings 34 at the opposite side of the machine are adapted to be controlled by means of vertically adjustable gates 36. These gates are adjustable in known manner by means indicated at 37.

The conveyor 23 previously referred to is supported at its opposite ends upon drums 40 the upper one of which is mounted upon a shaft 41, rotation of which is adapted to be effected by power applied to a wheel 42 fast upon the said shaft the other wheel 43 being loosely mounted on the said shaft. An opening 45 is provided in the side of the tank to permit an overflow of water therethrough to thereby control the top level of the water in the tank.

In the construction as illustrated in Figs. 1 and 2 of the drawings I have provided a hopper 50 from which the mixture of coal, slate, "bony" material, stone or the like is adapted to be discharged into the upper end of the branch pipe 6. For controlling the discharge of the coal or a mixture thereof with impurities from the hopper into the said branch I have provided a shaft 51 from which elongated blades 52 radiate, the said blades being angularly related to each other as shown to provide a series of pockets 53. Rotation of the shaft 51 and of the blades 52 therewith is effected by means of a sprocket wheel 54 mounted upon one end thereof and driven by a sprocket chain 55 which in turn is driven by a sprocket wheel 56 mounted upon one end of the shaft 41. As the shaft 51 and the blades 52 are rotated the pockets 53 discharge successively coal or a mixture of coal and impurities which has collected therein into the upper end of the branch pipe 6. The shaft 51 and the radial blades 52 carried thereby are adapted to be adjusted within the lower end portion of the hopper 50 in order to more effectively control and regulate the rate of feed of the coal, the mixture of coal and impurities into the upper end of the branch pipe 6. The shaft 51 is mounted at its opposite ends in the rear outer ends of arms 57 which are connected to the rear end of a lever 58 supported by means of a pivot 60 upon an upright post 61 supported medially of the apparatus as shown in Fig. 1 of the drawings. The lever 58 is provided with a plurality of holes 62 by means of which its point of connection to the upright 61 may be varied and the said upright also is provided with a plurality of holes 63 by means of which the pivot supporting the lever 58 may be raised or lowered as may be desired. The forward end portion of the lever 58 is provided with a weight 65 adjustable thereon. It will be apparent that when the pivot 60 is adjusted as above indicated the relation of the shaft 51 and the blades 52 carried thereby to the rear and front walls of the hopper will be varied and also that upon pivotal movement of the lever 58 about its pivot 60 the relation of the said shaft and blades to the rear wall will be varied. Pivotal adjustment or movement of the lever 58 about its pivot 60 is adapted to be effected automatically by means of a float 70 mounted upon and relatively immovable with respect to a depending link 71 pivotally connected at its upper end to the front end of the lever 58 as indi-

cated at 72. The float 70 is partly submerged in the water within the upper end portion of the pocket or compartment within which the conveyor 23 is located and its position is controlled and varied by the height of the water in the said compartment. The height of the latter in the said compartment depends upon the resistance offered by the coal or the mixture of coal and impurities in the upper end of the portion 3^b of the passageway 3. As the resistance increases the pressure of the water through the opening 20 and upwardly through the pocket or compartment within which the conveyor 23 is located increases, whereby the top level of the water in said pocket rises to effect an upward or rising movement of the weight 70 to thereby cause a lowering or descending movement of the shaft 51 and the blades 52 mounted thereon. Such action operates to decrease the amount of the coal or the mixture of coal and impurities supplied to the branch pipe 6 whereby the resistance offered to the flow of water through the passageway 3 is decreased and in consequence the level of the water within the compartment within which the float 70 is located falls to permit descending movement of the said float together with a corresponding pivotal movement of the lever 58. By this means the amount of coal or of the mixture of coal and impurities discharged from the hopper 50 is automatically, accurately, and practically controlled.

In the construction as illustrated in Figs. 1 and 2, the impurities are permitted to fall or pass freely through the opening 20, but it may be found desirable to provide means for preventing such free discharge of the impurities and I have therefore provided in the construction illustrated in Figs. 3 and 4 of the drawings, a shelf 80 supported upon a pivotal shaft located at the lower edge of the wall 30 previously referred to. The shelf 80 extends rearwardly and crosswise of the opening 20′ leading from the passageway 3 and is adapted to be adjusted by oscillating or pivoting the shaft 81 to which the said shelf is connected and by which it is supported. The shaft is pivotally adjusted by means of a handle 82 which is adapted to be held in adjusted position by means of a pin extending through an opening therein and into openings 83 provided in a quadrant 84.

By adjusting the shelf 80 about its axis the amount of slate, stone or the like which may gather thereon as indicated at 80′ may be varied. If the said shelf is adjusted in a downward direction the amount will be less than if adjusted into a slightly upwardly extending position as shown in the drawings. The presence of a mass of slate, stone, etc., such as 80′ tends to retard the flow of water through the bend of the passageway 3 at the lower side thereof, which in some instances, may be of advantage in the operation of the apparatus.

In Figs. 3 and 4 of the drawings the discharge of the coal to be washed from the hopper 85 through the opening 86 provided in the front wall thereof, is controlled by an adjustable valve or gate 87 slidably supported and adapted to be moved in a vertical plane so as to vary its relation to the opening 86. Movement or adjustment of the gate 87 is effected by means of a lever 89 pivoted intermediate its ends to a post 90. The rear end of the said lever is connected by means of a pin and slot connection to the gate or valve 87 as indicated at 91. The rear end of the said lever is connected with a float 70 by means of a link 71, the upper end of the latter being pivotally connected to the front end of the said lever. The variations or up and down movements of the float 70 to effect corresponding movements of the front end portion of the lever 89 are caused and brought about in identically the same manner as has been described in connection with the float and link correspondingly numbered in Fig. 2 of the drawings. If the float 70 moves upwardly, the rear end portion of the lever 89, which is connected to the gate or valve 87, is moved downwardly so as to partially close and restrict the opening 87 through which the coal to be washed is delivered from the hopper 85.

In the construction as illustrated in Figs. 5 to 7 inclusive, the coal which is carried upwardly through the passageway 5 by the action of the stream of water thereupon is discharged therefrom over the upper edge of an adjustable plate 90′ supported in guides at its opposite ends in overlapped relation to the upper edge of the outer side wall of the upwardly extending portion 3^b of the curved passageway through which the water flows in the apparatus as is apparent from Figs. 2, 4 and 5. The plate 90′ is adapted to be adjusted by adjusting means indicated as a whole at 91′ in known manner. By adjusting the plate 90′ vertically either upwardly or downwardly, it may be so located as to effect the most efficient operation of the apparatus. The coal is discharged directly from the passageway 5 into a discharge chute 92, the bottom of which is perforated to permit the escape of water therethrough into a passageway 93 by which it may be discharged at such point as may be desired.

The coal is delivered into the passageway 6 from a supply container shown in part at 94. The passage of the coal from the container 94 is controlled by an adjustable plate 95 which extends transversely of the opening leading from said container. By adjustment of the plate 95 its relation to the lower side of the discharge end portion of the container 94 may be varied.

For the purpose of regulating and controlling the discharge of the slate through the opening 20′ shown in Fig. 5 of the drawings, I have provided a plate 80′ constituting one side of said opening, which plate is pivotally supported at its upper edge by a pivot 96. For adjustment of the lower end portion of the plate 80′ toward and from the opposite edge of the opening 20′ I have provided a shaft 97 having a couple of disks 98 mounted eccentrically thereon as shown. The hinged or pivoted plate 80′ rests against the edges of the said disks and by rotating the shaft and the said disks, adjustment of the said plate toward and from the opposite edge of the opening 20′ may be effected to thereby vary the area of said opening. Rotative adjustment of the shaft 97 with the eccentric disks 98 thereon is adapted to be effected by the crank 99 secured to one end thereof as shown in Fig. 7.

The slate, stone and other relatively heavy material constituting the impurities in the coal after having been discharged through the opening 20′ descends into a receiving passageway 100 which is inclined towards the right, as shown in the drawings, and terminates in a flat portion 101 from which it is removed by the buckets 102 carried by the endless conveyor 103. The said conveyor is supported upon the sprocket wheels 104 and 105, the latter being driven by a sprocket chain 106 which drives a sprocket wheel 107 mounted on one end of the shaft upon which the sprocket wheel 105 is mounted. The driving means for the sprocket chain 106 is not shown.

It will be seen that by my invention, I have provided apparatus of simple construction by the employment of which a continuous washing process may be effected; and it has been found that a machine of this character operates with great efficiency.

Having thus described my invention what I claim and desire to secure by Letters Patent is:

1. In apparatus for washing coal, the combination of a conduit having downwardly and upwardly extending portions, to the upper end of the former of which a washing medium is adapted to be supplied continuously and at substantially constant pressure, the said conduit having a port in the convex side thereof, and the upper portion of the upwardly extending portion of said conduit being enlarged from front to rear and being divided into two branches, means for supplying coal to be washed to one of said branches, the said coal in its descending movement meeting the upwardly flowing stream of water in the said enlarged portion and being carried thereby upwardly through the other of said branches into a compartment from which it is discharged, and means whereby the variation of the resistance offered by the coal which is being washed to the upwardly flowing stream of water operates to control the supply of coal to said branch.

2. In apparatus for washing coal, a conduit having downwardly and upwardly extending portions, the said portions being connected by a curved portion and the upwardly extending portion being enlarged from front to rear, and the said conduit being provided with a port in the convex side of the said curved portion, means for supplying water to the downwardly extending portion of said conduit, means projecting into the upwardly extending portion of said conduit to divide the same into two branches, means for supplying a mixture of coal and impurities to one of the said branches, the said mixture descending in said branch to meet an upwardly flowing stream of water in said upwardly extending portion of the said conduit, the said stream operating to cause a corresponding movement of the coal of said mixture to separate the same from the said impurities which latter continue their descent in the said conduit and escape through the opening therein, substantially as described, and means whereby the variation of the resistance offered by the coal which is being washed to the upwardly flowing stream of water operates to control the supply of coal to said branch.

3. In apparatus for washing coal, the combination of a conduit having downwardly and upwardly extending portions connected at their lower ends by a curved portion having an opening in the convex side thereof, means for supplying water to the upper end of the downwardly extending portion of said conduit, means projecting into the upper end of the upwardly extending portion of said conduit to divide the same into two branches in front and rear relation to each other, means for supplying a mixture of coal and impurities to the rear branch which mixture descends therein and enters the said conduit at a point below the said means for dividing the upper end of the upwardly extending portion thereof into two branches where it meets an ascending stream of water, the coal being thereby carried upwardly and the impurities allowed to descend and to escape through the said port, and means actuated by variations of the resistance offered to the flow of the ascending stream of water for controlling the rate of discharge of the said mixture into the said branch.

4. In apparatus for washing coal, the combination of a conduit having downwardly and upwardly extending portions which portions are connected by a curved portion having a port in its convex side, adjustable means for varying the size of said opening, means for supplying water to the upper end of the downwardly extending portion of said conduit, means projecting into the upper end of the upwardly extending portion of said

conduit to divide the same into two branches in front and rear relation to each other, means for supplying a mixture of coal and impurities to the rear branch through which branch the said mixture descends and enters the upwardly extending portion of said conduit in the region thereof below the said means for dividing the upper end thereof into branches, the coal being carried upwardly with the upward flow of water through the upwardly extending portion of said conduit and said last mentioned branch and the impurities descending in opposition to the flow of water through said branch and escaping through the said port, and means actuated by variations of the resistance offered by the mixture of coal and impurities in the upwardly extending portion of said conduit and acting automatically to control the discharge of coal into the said rear branch.

5. In apparatus for washing coal, the combination of a conduit having downwardly and upwardly extending portions connected at their lower ends by a curved portion having an opening in the convex side thereof, means whereby the area of said opening may be varied, means for supplying water to the upper end of the downwardly extending portion of said conduit, means projecting into the upper end of the upwardly extending portion of said conduit to divide the same into two branches in front and rear relation to each other, means for supplying a mixture of coal and impurities to the rear branch which mixture descends therein and enters the said conduit at a point below the said means for dividing the upper end of the upwardly extending portion thereof into two branches where it meets an ascending stream of water, the coal being thereby carried upwardly through the front branch and discharged therefrom, means for varying the point of discharge of the coal from the said last mentioned passageway, and means adapted to be actuated by variations of the resistance offered to the upward flow of the ascending stream of water for regulating the delivery of coal and impurities to said rear branch.

6. In apparatus for washing coal, the combination of a conduit having downwardly and upwardly extending portions to the upper end of the former of which a washing medium is adapted to be supplied continuously and at substantially constant pressure, the said conduit having a port in the convex side thereof and the upper part of the upwardly extending portion of said conduit being divided into two branches, means for supplying coal to be washed to one of said branches, the said coal in its descending movement meeting the upwardly flowing stream of water in the upwardly extending portion of said conduit and being carried thereby upwardly through the outer of said branches into a compartment from which it is discharged, a compartment formed in adjoining relation to said conduit having a pocket therein adapted to receive the impurities discharged from said conduit, means for removing said impurities upwardly and out of said pocket, and means positioned in said last mentioned compartment and adapted to respond to the changes in level of the water therein to automatically control the said first named means.

7. In apparatus for washing coal, the combination of a conduit having downwardly and upwardly extending portions which portions are connected by a curved portion having a port in its convex side, adjustable means for varying the size of said opening, means for supplying water to the upper end of the downwardly extending portion of said conduit, means projecting into the upper end of the upwardly extending portion of said conduit to divide the same into two branches in front and rear relation to each other, means for supplying a mixture of coal and impurities to the rear branch, through which branch the said mixture descends and enters the upwardly extending portion of said conduit in the region thereof below the said means for dividing the upper end thereof into two branches, the coal being carried upwardly with the upward flow of water through the upwardly extending portion of said conduit and the front branch, the impurities descending in opposition to the flow of water through the upwardly extending portion of said conduit and front branch and escaping through the said port, a compartment provided in contiguous relation to said conduit having a pocket therein adapted to receive the impurities discharged from said conduit, and means responsive to the changes in the level of water in said compartment for controlling the discharge of coal into the said rear branch.

In testimony that I claim the foregoing as my invention, I have hereunto signed my name this 30th day of November, A. D. 1927.

FRANCIS H. BLATCH.