E. G. BURKS & N. HAYES.

COAL WASHING APPARATUS.

APPLICATION FILED AUG. 16, 1915.

1,201,143.

Patented Oct. 10, 1916.

3 SHEETS—SHEET 1.

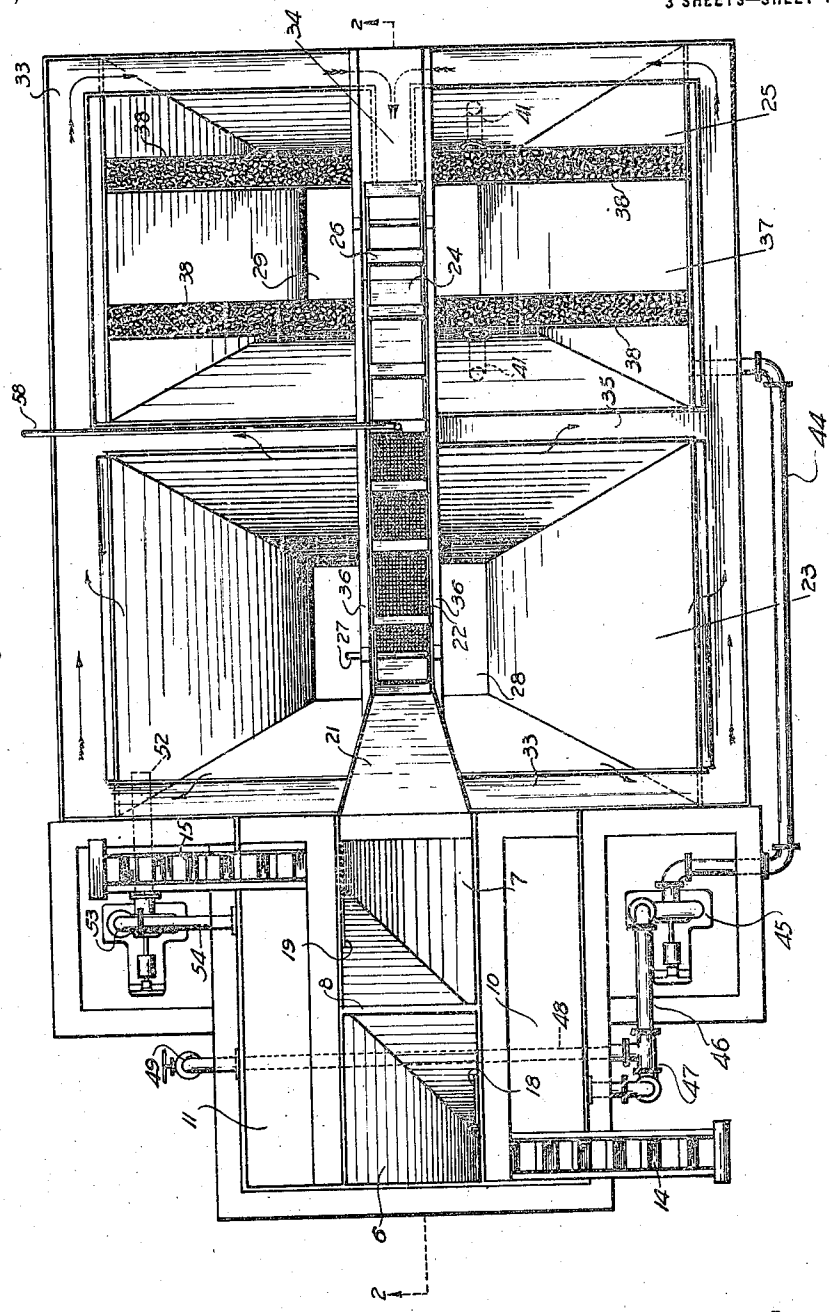


Fig. 1

WITNESSES:

J. Gordon Harbison.

Wm. C. Daughtry

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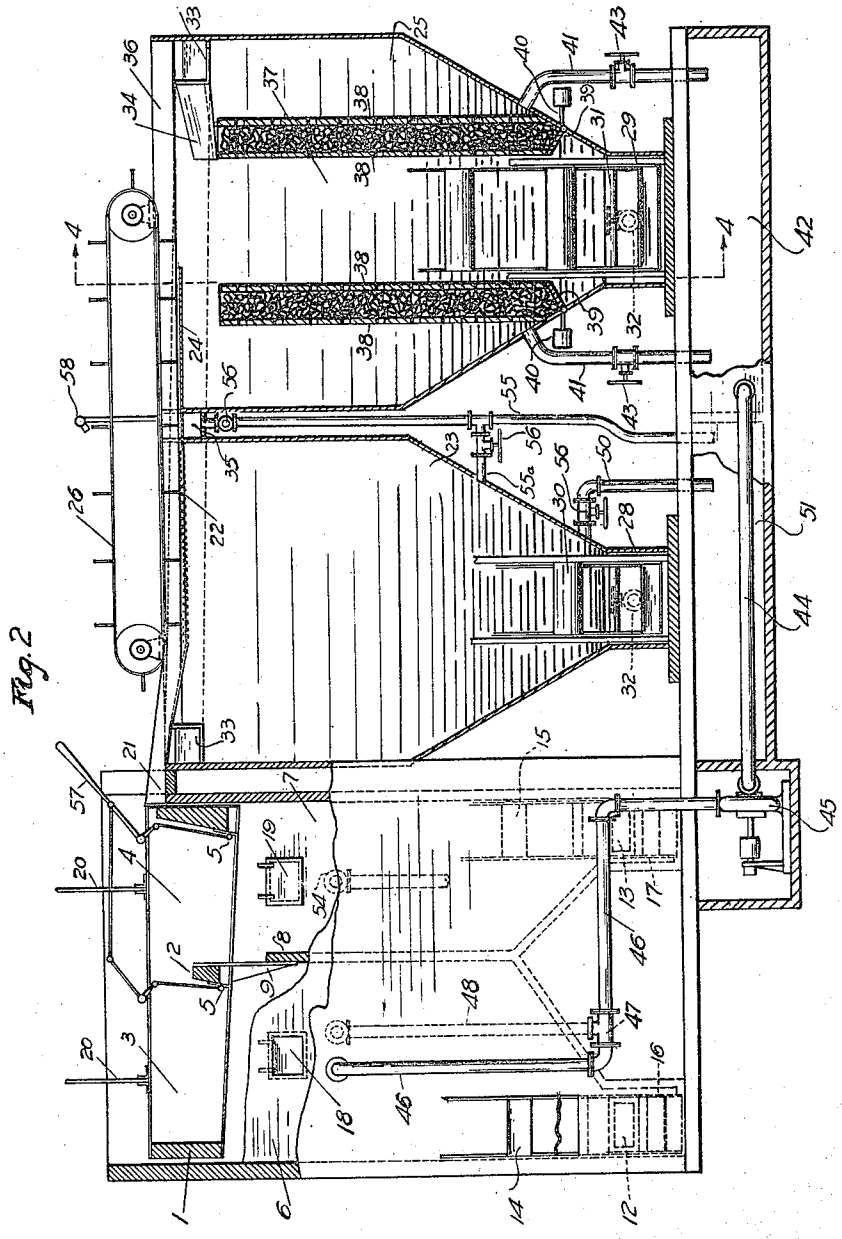


Fig. 2

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3 SHEETS—SHEET 3.

Fig. 4

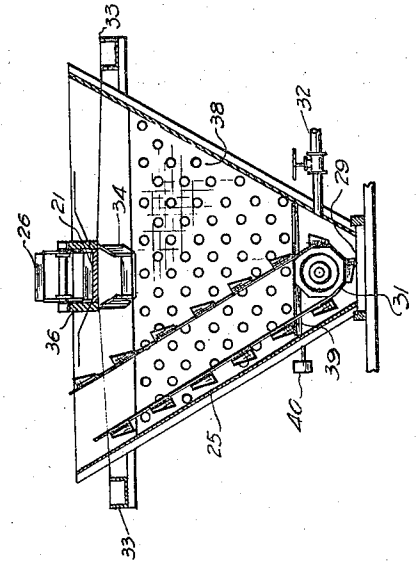
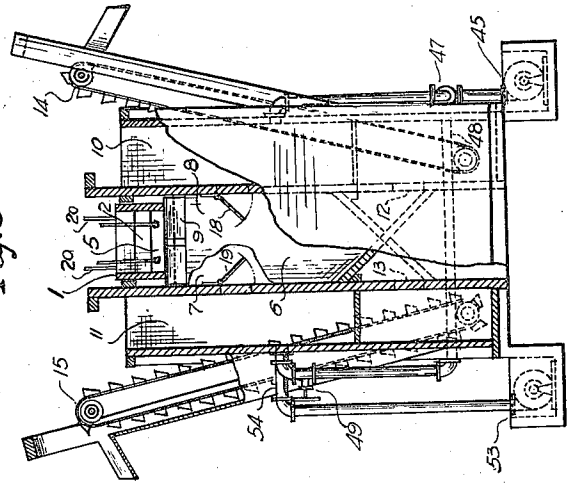


Fig. 3



WITNESSES:

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UNITED STATES PATENT OFFICE.

EUGENE G. BURKS AND NEENIAN HAYES, OF BIRMINGHAM, ALABAMA.

COAL-WASHING APPARATUS.

1,201,143. Specification of Letters Patent. Patented Oct. 10, 1916.

Application filed August 16, 1915. Serial No. 45,705.

To all whom it may concern:

Be it known that we, EUGENE G. BURKS and NEENIAN HAYES, citizens of the United States of America, residing at Birmingham, in the county of Jefferson and State of Alabama, have invented certain new and useful Improvements in Coal-Washing Apparatus, of which the following is a specification.

Our invention relates to coal washing mechanism wherein a reciprocable jigging apparatus is employed to separate the slate and bone coal from the clean coal.

The chief object of our invention is to reduce to a minimum the loss of fine coal in washers of the reciprocable jig type by a novel control of the water returned from the settling tanks to the jig tanks.

A further object is to adapt our washing mechanism to separate and enrich bone coal so as to convert it into fuel commercially valuable as boiler coal. This we accomplish by the return of the waste water with a large percentage of fine coal in suspense therein to the bone coal elevator tank wherein the fine coal settles on the bone coal and both are taken out by the elevator.

Another distinctive feature of our invention is the arrangement by which the water returned to the jig tank through the bone coal elevator is confined to the jig tank under the bone coal separating jig so that any fine coal not deposited in its first passage through the bone coal elevator tank will be inevitably returned to such tank by its settling in the bone coal jig tank and passing therefrom into the bone coal elevator tank with the bone coal.

A further feature of our invention relates to the novel construction of the settling tanks and the manner of returning the overflow and waste water from the settling tanks to the jigs.

Our invention further comprises the various novel details of construction and arrangements of parts which are hereinafter more particularly described, reference being had to the accompanying drawings forming a part of this specification, and in which:—

Figure 1 is a plan view of a coal washing apparatus shown with the jig removed and the elevators in the settling tanks omitted. Fig. 2 is a longitudinal vertical section on the line 2—2 of Fig. 1. Fig. 3 is an end elevation of the jig box partly broken away to show the parts of the interior jig mechanism. Fig. 4 is a vertical section on the line 4—4 of Fig. 2, the view being reduced in size.

Similar reference numerals refer to similar parts throughout the drawings.

As an illustrative embodiment of our invention we have shown in the drawings a washing apparatus comprising a slate jig, a bone coal jig and an initial settling tank for the fine coal and a water filtering settling tank for the lump coal. It will be understood however that our apparatus contemplates the use of a greater number of jigs and settling tanks if it be desired to further refine the treatment of the coal. As shown we employ a reciprocable jig 1 having a foraminous bottom and divided by an intermediate transverse partition 2 into a forward compartment 3 for separating slate from the coal and the bone coal, and a rear compartment 4 for separating the bone coal from the coal. Suitable gates 5 are provided for each jig section and are adjustable to control the discharge of slate from jig compartment 3 into the slate jig tank 6, and the discharge of bone coal from jig compartment 4 into the bone coal jig tank 7. These two jig tanks 6 and 7 are of considerable depth and are separated from each other by a transverse intermediate partition 8 which is lapped at its upper end by a slide plate 9 movable with the jig and serving to further separate the tanks 6 and 7. The bottom of the jig tank 6 is formed by two sloping walls which converge hopper-like toward the slate outlet port 12 near one corner of the jig box while the bottom walls of the tank 7 converge similarly toward the bone coal outlet port 13 near the diametrically opposite corner of the jig box from port 12.

We provide a slate elevator tank 10 on one side of the jig and a bone coal elevator tank 11 on the opposite side of the jig, these two elevator tanks preferably extending the full length of the jig but are disconnected from the jig tank except through the ports 12 and 13 respectively. We provide an elevator 14 for the slate and an elevator 15 for the bone coal, arranging these elevators crosswise of their respective tanks and at the ends thereof near the ports 12 and 13. The lower ends of the elevators work in pockets 16 and 17, respectively, into which the slate and bone coal are discharged from their respective jig tanks. By this arrangement these elevators will cause a minimum disturbance of the water in their respective tanks, which is

important in tank 11. Water is admitted from the upper portion of tank 10 into jig tank 6 by a flap valve 18 disposed within the jig tank and water is admitted by a flap valve 19 from the tank 11 into the jig tank 7, suitable ports being provided in the side walls of the jig tanks opposite these flap valves which open inwardly responsive to the upward movements of the jig to draw in a supply of water into the jig tanks. It should be noted that there is no communication between tanks 6 and 11 and none between the tanks 10 and 7, it being our purpose to provide two separate circulation systems for the return of water to the jig tanks 6 and 7.

As the jig is reciprocated by suitable driving connections 20 to operating mechanism (not shown) of any well known type, the water forced up through its perforated bottom from tank 6 will carry the coal and bone coal over the partition 2 and that forced up from tank 7 will carry the clean coal over the lower end of the jig box and along a chute 21 which has a screen 22 in its bottom where it passes over the fine coal settling tank 23. Beyond this tank the chute continues with a solid bottom 24 to a point over the center of a settling tank 25, which we term the large coal or filtering tank. An endless conveyer 26 is driven by a power shaft 27 and serves to move the coal over the screen 22 and along the chute and to discharge it into tank 25. It will be noted that these two settling tanks have each a hopper bottom, the four walls of which converge toward wells 28 and 29, respectively. These wells are of substantial depth and are designed to fit closely around the lower ends of their respective elevators 30 and 31 which are set down into these wells 28 and 29. These settling tanks are preferably made deeper than is customary and their elevators are preferably driven at a very slow speed so as to reduce to a minimum the agitation of the water in these tanks. This will, of course, necessitate an increase in the size of the buckets to compensate for the decreased speed. The arrangement of the hopper bottoms and the wells serves to effectively concentrate all settling coal into position to be caught by the elevator buckets and lifted out of the tanks. Each of the settling tanks is provided with a valved clean out pipe 32.

The circulation of the water between the settling tanks and its return from the settling tanks to the elevator tanks 10 and 11 is provided for in the following manner: A trough 33 passes under the chute 21 and, overhanging the left hand end of the tank 23 (Fig. 2), extends through each side of that tank and then at each end takes a right angle turn and extends along each side of both tanks 23 and 25 and then is brought in through the side walls at the right hand end of tank 25 and leads to a chute 34 which overhangs the central portion of the tank 25. The tank 23 has overflow lips along each side which direct the water into the side sections of trough 33. A cross trough 35 is provided between the tanks 23 and 25 and opens at each end into the trough 33. It will thus be seen that the troughs 33 and 35 completely surround the first settling tank 23 so that a uniform overflow therefrom about its entire upper edge is provided for. As indicated in Fig. 2, the adjacent sides of tanks 23 and 25 above trough 35 are cut away for the coal conveyer chute and for the two side bars 36 which extend from end to end over the tanks and support the conveyer and the chute in which it operates.

The large coal settling tank 25 is subdivided by two transverse filtering partitions so as to form a central compartment or filter well 37 in which the elevator 31 works and into which the lump coal is discharged from the chute 24 and the overflow water from the tank 23 through the chute 34. This filter compartment is somewhat analogous to the construction shown in our Letters Patent No. 1,112,976, each filter wall being formed by a pair of spaced perforated plates 38 the space between which is filled in with coal to form a granular bed of from 8 to 14 inches in thickness, depending on the filtering capacity required. In our present arrangement the filter is designed to handle a considerable volume of water and it is formed by parallel filter walls extending from side to side of the compartment of the tank and from the top to the bottom on the tank on each side of the well 29 therein. Each filter wall is provided with a movable bottom 39 hinged to its respective outer plate 38 and operable by a crank arm 40 which extends through an end of the tank so that these bottom doors can be dropped when desired and the filtering bed discharged into the well 29. The cranks are counterweighted or otherwise normally held with the doors closed. The tank 25 being divided by its two filtering walls into three compartments, it is necessary to provide two outlets for the filtered water which percolates from the central well 37 through the filters into the two outer compartments of the tank. This we accomplish by means of pipes 41, one of which leads from each end of the tank and discharges into a sump 42 below the tank. We provide a valve 43 in each pipe 41 and the water from the sump 42 is conveyed by a pipe 44 to a contrifugal pump 45 which elevates it through a pipe 46 to the upper portion of the tank 10. From a T-fitting 47 in the lower portion of the pipe 46 a pipe 48 leads across under the jig tank up to the upper portion of the tank 11 and this pipe is a normally closed valve 49. By opening

this valve 49 the pump 45 will supply clean filtered water to both tanks 10 and 11, but generally the tank 11 is supplied with waste water from the lower portion of the tank 23 which flows therefrom through a pipe 50 into a sump 51 below the tank 23 and thence through a pipe 52 (see Fig. 1) to a pump 53 which delivers it through a pipe 54 into the tank 11 at a point near the elevator 15. We provide a pipe 55 which opens into the bottom of trough 35 and has a branch connection 55[a] opening into tank 23 at a point midway between pipe 50 and the trough 35. We provide valves 56 to control the flow of water through these several pipes. The object in arranging these pipes at different levels is to draw off water with varying percentages of fine coal therein into the sump 51 so that the quantity of fine coal deposited on the bone coal in tank 11 per unit of water pumped therethrough can be regulated. A small quantity of fresh water is added by pipe 58 to maintain the volume of circulating water. This pipe is arranged to spray water into trough 24 so as to wash the lump coal while over screen 22, thereby decreasing materially the percentage of fine coal that finds its way into the tank 25.

In operation, the jig gates 5, having been adjusted by the lever 57, and the crank mechanism controlled thereby, to the desired operating position, the jig is reciprocated and the slate delivered to the tank 6 and the bone coal into the tank 7. The slate passes through port 12 into the slate tank 10 and is carried off by the elevator 14 and the bone coal passes through port 13 into the bone coal elevator tank and is carried off by the elevator 15. The coal and overflow water from the jig pass along chute 21 and over screen 22 through which the fine coal and water fall into the settling tank 23, while the larger coal is delivered from the chute 24 into the well 37 in the settling tank 25. The fine coal settles to the bottom of the tank 23 and is removed therefrom by the elevator 30 and the larger coal is removed from the well 37 of settling tank 25 by the elevator 31. As thus operated a large percentage of very fine coal will be in suspense in the water in settling tank 23 and this fine coal is usually lost either by being carried off with the waste water or, as in the case of the Stewart jigs, by being introduced into the jig tank below the jig where it settles and passes off with the slate. According to our invention this fine coal, that would be lost in the manner described, is saved, the same being carried with the return circulation of dirty water from tank 23 through pipe 50 into the sump 51 and thence through pipe 52, pump 53 and pipe 54 into the bone coal elevator tank 11. In this tank 11 the dirty water with the fine coal in suspense is brought very nearly to rest so that the fine coal is deposited in the bottom of the tank and is carried out with the bone coal, thereby enriching the latter to the extent necessary to make it available for boiler coal. If there should be agitation in tank 11 causing an appreciable percentage of the fine coal to pass with the water supply through valve 19 into tank 7, it will settle in this tank and pass out through port 13 back to the tank 11 and be carried out with the bone coal. It will thus be seen that the dirty water returned from the sump 51 will ultimately deposit all of its fine coal in the elevator tank 11 so that it will be recovered and taken off with the bone coal. The water after settling in the tank 23 overflows about the top thereof and passes through the trough 33 and chute 34 into the well 37 in passing from which it is filtered and delivered as clean filtered water through pipes 41 to the sump 42 and thence returned through pipe 44 to pump 45 and pipe 46 to the slate tank thence it passes through valve 18 into the jig tank 6. Any fine coal in the overflow water from tank 23 is caught in the filtering beds of coal in tank 25 and will not be lost. If, for any reason, it should be desired to interrupt the return circulation through pump 53, such return circulation can all be passed through trough 33 and the filter to pump 45 and by operating valve 49 the bone coal tank 11 will be supplied with clean water, the pump 45 having a capacity sufficient to supply both tanks 10 and 11 when called upon. Also, if desired, the overflow water from tank 23 can be passed direct to sump 51 and thence to tank 11. Our piping system enables us to obtain an extremely flexible control of the water return circulations so that the same can be readily adapted to different kinds of coal.

A divisional requirement having been made with reference to the detail construction of the filtering tank, the wells for the elevators in both tanks and the overflow trough arrangement for these tanks, such features are not separately claimed herein.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent, is:—

1. In a coal washer, jigs, one of which is adapted to separate the slate from the coal and another to separate the bone coal from the coal, separate jig tanks for the bone coal and slate, separate elevator tanks for the slate and bone coal, means to admit a return circulation of water between the elevator tank and jig tank for the bone coal, means to admit a return circulation of water between the elevator tank and jig tank for the slate, a plurality of settling tanks, means to deliver the fine coal and overflow water from the jigs into one settling tank and the larger coal into another settling tank, means to return the water from the

large coal tank to the slate elevator tank, means to return the water and fine coal, that would otherwise pass off with the waste water, to the elevator tank for the bone coal, and elevating means in said elevator tanks.

2. In a coal washing apparatus, the combination with separate jig tanks, of jigs successively acting on the coal and adapted to deliver slate into one of the tanks and bone coal into another of the tanks, a slate elevator tank communicating with one jig tank, a bone coal elevator tank communicating with the other jig tank, a plurality of settling tanks, means to deliver the fine coal into one of the tanks and the larger coal into another of the tanks, elevators for said settling tanks, means to conduct the overflow from the fine coal tank into the large coal tank, filters in the large coal tank, means to return the filtered water from the large coal tank to the slate elevator tank, and means to return unfiltered dirty water from the fine coal tank to the bone coal elevator tank.

3. In a coal washer, the combination with a jig, a jig tank and an elevator tank for slate, of a jig, a jig tank and an elevator tank for bone coal, a fine coal settling tank, a large coal settling tank, means to distribute coal to said tanks, means to conduct the overflow water from the fine coal to the large coal settling tank, means to return water from the large coal tank to the slate elevator tank and to return dirty water from the fine coal tank to the bone coal elevator tank, and automatic valves controlling the flow of water from said elevator tanks to their respective jig tanks, responsive to the operation of the jigs, and elevators for said several tanks excepting the jig tanks, substantially as described.

4. In a coal washing apparatus, the combination with jigging mechanism, of a plurality of overflow tanks, means to distribute the fine coal from said mechanism to one of said tanks and the large coal to another of said tanks, a filter in the large coal tank forming an elevator well into which the large coal is fed, means to conduct an overflow of water from the fine coal tank into the filter well with the large coal, and means to draw off filtered water from the large coal tank and return it to the jigging mechanism, substantially as described.

5. In a coal washing apparatus, the combination with jigging mechanism, of a plurality of overflow tanks, means to distribute the fine coal from said mechanism to one of said tanks and the large coal to another of said tanks, a filter in the large coal tank forming an elevator well into which the large coal is fed, means to conduct an overflow of water from the fine coal tank into the filter well in the large coal tank, means to draw off filtered water from the large coal tank and return it to the jigging mechanism, and independent means to return dirty water from the fine coal tank to the jigging apparatus, substantially as described.

6. The combination with a coal washing apparatus comprising a jig for separating bone coal from coal, a jig tank, an elevator tank communicating with said jig tank, which latter is adapted to deliver the bone coal and other matter into said elevator tank, of an automatic valve responsive to the operation of the jig and adapted to admit water from said elevator tank to said jig tank, a settling tank which receives the overflow from the jigs, and means to return dirty water from the settling tank into said bone coal elevator tank, and elevators in said elevator tank and settling tank, substantially as described.

7. In combination a coal washing apparatus, settling tanks comprising a fine coal settling tank, a large coal settling tank, a filtering well for said large coal tank, means to introduce the overflow from the fine coal tank into said well, means to deliver the large coal into said well, elevators operating in said well and fine coal tank, means to draw off the filtered water from said large coal tank and return it to the washing apparatus, an elevator tank connected with the washing apparatus, and means to return the dirty waste water from said fine coal tank through said latter elevator tank to the washing apparatus, substantially as described.

8. In a coal washing apparatus, the combination with jigging mechanism, of a plurality of overflow tanks, means to distribute the fine coal from said mechanism to one of said tanks and the large coal to another of said tanks, a filter in the large coal tank, means to conduct an overflow of water from the fine coal tank into the filter, and means to draw off filtered water from the large coal tank and return it to the jigging mechanism, substantially as described.

9. In a settling apparatus for coal washers, the combination of two tanks and an elevator for each tank, jigging means, means to deliver fine coal and overflow water from the jigs to one tank, means to deliver the larger coal to the second tank, a filtering compartment formed in said second tank by means of perforated walls and a granular filler, said walls surrounding and separating the elevator from the rest of said tank, means to conduct the overflow water from said fine coal tank into said filtering compartment, into which the large coal is also delivered, and means to draw off unfiltered water from the first tank and filtered water from the second tank, substantially as described.

10. In a coal washer, a jig tank divided transversely into two compartments, one for

slate and one for bone coal, a jig reciprocable in said tank and adapted to discharge slate into one tank and bone coal into the other, elevator tanks for the slate and bone coal which are disposed on each side of the jig tank, valve means to feed the water from the slate elevator tank to the slate jig tank only, valve means to feed the water from the bone coal elevator tank to the bone coal jig tank only, and means to supply water to said elevator tanks, substantially as described.

In testimony whereof we affix our signatures.

EUGENE G. BURKS.
NEENIAN HAYES.

Witness:
NOMIE WELSH.