

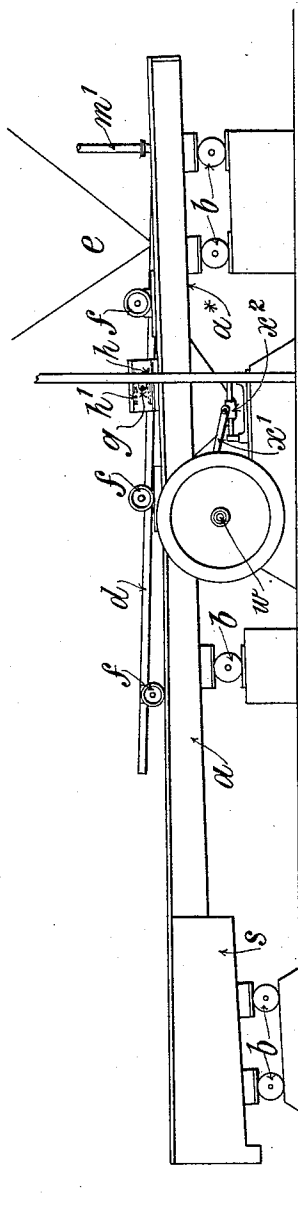
R. S. BENSON.  
MACHINE FOR WASHING OR SEPARATING COAL, ORE, AND OTHER GRANULAR OR LIKE MATERIALS.  
APPLICATION FILED JUNE 3, 1912.

1,069,223.

Patented Aug. 5, 1913.

3 SHEETS—SHEET 1.

FIG. 1.



WITNESSES

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3 SHEETS—SHEET 2.

FIG. 2.

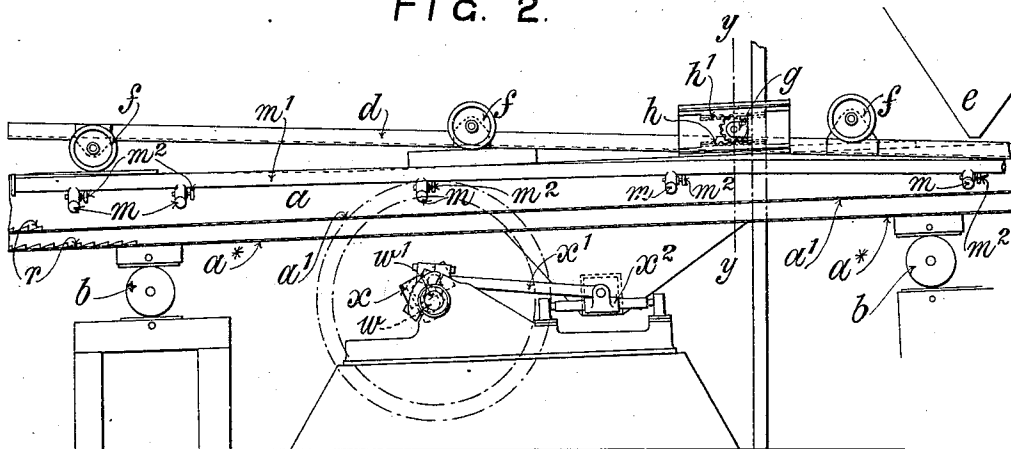


FIG. 3.

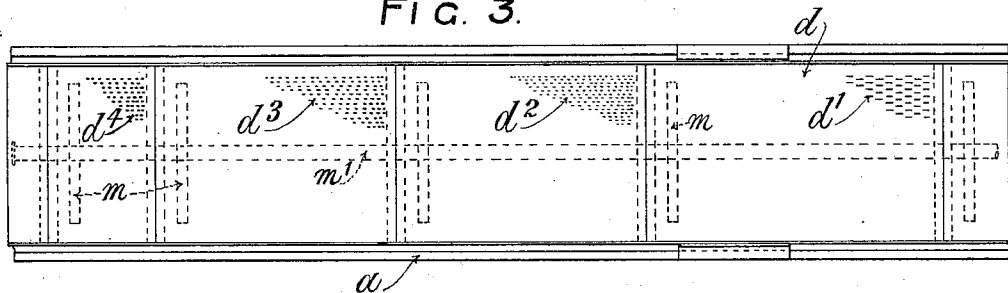
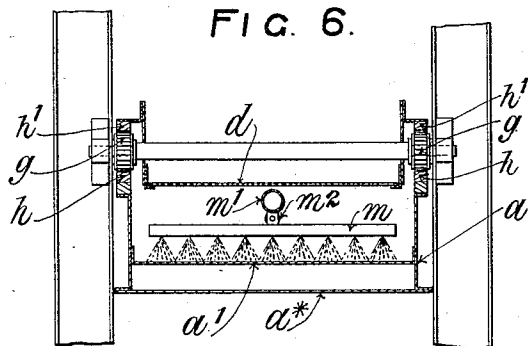


FIG. 6.



WITNESSES

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3 SHEETS—SHEET 3.

FIG. 4.

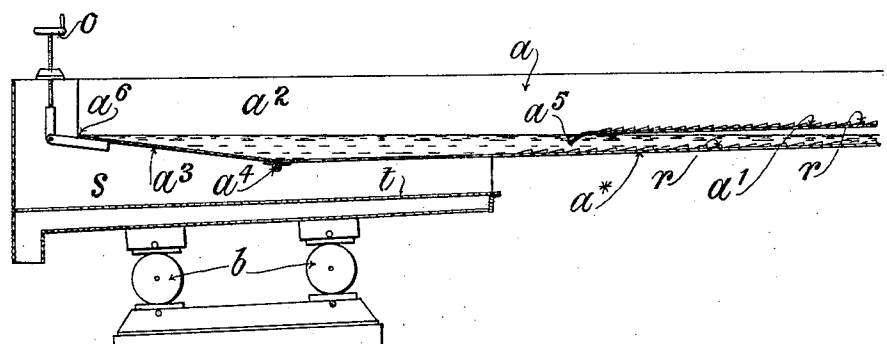
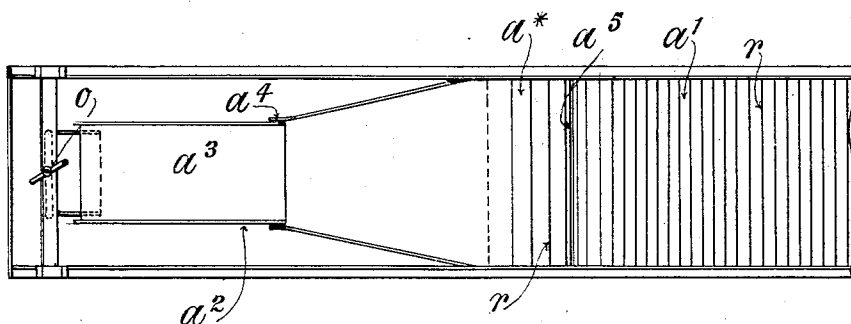


FIG. 5.



WITNESSES

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# UNITED STATES PATENT OFFICE.

ROBERT SEYMOUR BENSON, OF MIDDLETON ST. GEORGE, ENGLAND.

MACHINE FOR WASHING OR SEPARATING COAL, ORE, AND OTHER GRANULAR OR LIKE MATERIALS.

1,069,223.

Specification of Letters Patent.

Patented Aug. 5, 1913.

Application filed June 3, 1912. Serial No. 701,227.

*To all whom it may concern:*

Be it known that I, ROBERT SEYMOUR BENSON, a subject of the King of Great Britain and Ireland, and residing at "Riverside," Middleton St. George, in the county of Durham, England, have invented a new and Improved Machine for Washing or Separating Coal, Ore, and other Granular or Like Materials, of which the following is a full and complete specification.

This invention relates to improvements in machines for washing or separating coal, ore, and other granular or like materials in which the washing or separation is effected by subjecting the material to a conveying motion operating in one direction and to a stream of water flowing in the opposite direction, and the objects of my improvements are, first, to subject the different sizes of the material to variable flows of water; second, to subject the lighter components of the material after the first washing to a second washing effected by the surging action of a volume of water; third, to facilitate the separation of the heavier components from the lighter components after the second washing; fourth, to provide for the adjustment of the machine so that it will treat materials of varying specific gravities; and fifth, to increase the output of this class of machine. I attain these objects by the construction illustrated in the accompanying drawing, which shows a machine for washing coal, and in which:—

Figure 1, is a diagrammatic view in vertical elevation of the entire machine, Figs. 2 and 3, are a broken longitudinal section and a plan respectively—on an enlarged scale—showing a part of the machine. Figs. 4 and 5, are a broken longitudinal section and a plan respectively—on an enlarged scale—showing another part of the machine, and Fig. 6, is a transverse section on line  $y\ y$  Fig. 2.

Throughout the views similar parts are marked with like letters of reference.

The trough  $a$ , which is mounted on rollers  $b$ , is suitably inclined and has mechanism for imparting to it a conveying motion of the alternate reciprocating type. Any of the well known "head motions" for imparting differential speed may be employed.

The trough  $a$  has a deck or false bottom  $a^1$  at a suitable distance above its bed  $a^2$ , and above said deck is a feed tray  $d$  the bed

of which has a series of graduated perforations  $d^1$ ,  $d^2$ ,  $d^3$  and  $d^4$ , the smallest being at that end of said tray nearest to the higher end of the trough. Above the end of the feed tray having the smallest perforations is a hopper  $e$  into which the coal to be washed is delivered and out of which it passes on to the feed tray. This feed tray is mounted on rollers  $f$  in a similar manner to the trough  $a$  and has a conveying motion imparted to it in the opposite direction to that of the trough. A convenient method of effecting this is to couple the feed tray to the trough by mechanism comprising a pair of racks  $h$  and  $h^1$  gearing with a common pinion  $g$ , one of the racks  $h$  being carried by the trough and the other  $h^1$  by the feed tray. Between the feed tray  $d$  and the deck  $a^1$  are five transversely arranged water delivery pipes  $m$  fed by a common pipe  $m^1$ . The pipes  $m$  are each located just behind—that is, toward the higher end of the trough—the commencement of each series of perforations in the bed of the feed tray, and are pierced with a series of spaced holes so as to split up the water into a series of streams. Each pipe  $m$  is either made of such a size or is provided with a cock  $m^2$  so that the water flowing from each is or can be adjusted to suit the size of the coal passing through the section of the feed tray immediately in advance of it. These water delivery pipes may either be fixed in relation to the trough and the feed tray, as shown in the accompanying drawings, or they may be carried by one or other of them so as to partake of the same motion.

The lower end  $a^2$  of the trough  $a$  is made dish-shaped so as to hold up a certain volume of water, and said end is provided with an adjustable bottom or bed  $a^3$  hinged at  $a^4$  and provided with suitable mechanism, such as the hand screw  $o$  as shown in Fig. 4, for raising and lowering it for the purpose both of varying the inclination of the bed at this end of the trough and of varying the depth, and therefore the volume, of water in said end. The lower end of the trough can also with advantage be contracted in width, as shown in Fig. 5, but this is not obligatory. The deck  $a^1$  extends so far down the trough that its lower end  $a^5$  will be submerged by the water held up in the lower end of the trough, which enables the fine heavy impurities which collect in the lower end of

the trough to be conveyed back up the trough under the deck  $a^1$  without coming under the influence of the water flowing down the deck. To enable the deck to be kept as short as possible, its lower end  $a^5$  may be set down as shown in Fig. 4. The bottoms both of the trough  $a$  and the deck  $a^1$  are provided with riffles  $r$ .

Formed in one with the lower end  $a^2$  of the trough  $a$  is a receptacle  $s$  into which the water and coal passing over the closed end of the trough falls, said receptacle being provided with a screen  $t$  for separating the washed coal and the water.

The action of the apparatus is as follows:—The coal to be washed is fed from the hopper  $c$  on to the perforated feed tray  $d$  and is conveyed along or over the perforations of same by reason of the conveying motion imparted to it, the screenings passing through it, and the oversize passing over the end of it. Each size as it falls on to the deck  $a^1$  of the trough is met by a graded flow of water from the pipes  $m$ , the strength and volume of each flow of water being sufficient to float the lighter substance (the coal) down the deck of the trough but not sufficient to offer so great a resistance to the heavier substance (the shale or other impurities) as to overcome the conveying action of the trough which is in the opposite direction to that of the flow of the water. The water in the lower end  $a^2$  of the trough will be in violent agitation due to the surging action set up by the motion of the trough, which motion, however, is insufficient to impart a conveying motion to this volume of water against the flow of the water from the deck. As the volume of this surging water increases due to the amount flowing into it a portion of it passes over the edge  $a^5$  of its lower end  $a^2$  during each reciprocation of said trough. When the coal falls on to the deck  $a^1$  of the trough it is at once subject to the opposed forces of the conveying motion—upward—and the water—downward—under which the materials of different specific gravity become separated, the lighter having a tendency to rise and the heavier to fall in the water, whereby the former are brought more out of the influence of the conveying motion and more under the influence of the flowing water, and the latter are brought more under the influence of the conveying motion and less under the influence of the water, so that the former are caused to travel down the trough and the latter up the trough. When the lighter material reaches the surging volume of water it is once more subjected to separating influences, the lighter rising to the top and washing over the edge  $a^5$  of the lower end  $a^2$  of the trough and the heavier sinking to the bottom and being carried up the trough under the deck  $a^1$  and

in due time delivered over the upper end of the trough.

When this machine is intended to treat certain materials, such for instance as those which have no small or fine component parts, or those in which the component parts are of like or of uniform size, the deck or false bottom  $a^1$  may be dispensed with so that the material passes direct from the feed tray on to the bed of the trough.

In setting this machine to work the total volume of water admitted to the trough must be adjusted so that it bears an approximately fixed relation to the conveying motion and to the difference between the specific gravities of the components of the material to be washed, the conveying motion being in all cases sufficient to cause the heavier material to travel up the trough against the flow of the water, and the flow of the water being sufficient—co-acting with its buoyancy—to cause the lighter material to travel downward against the conveying motion.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In a machine for washing materials of a granular or like nature, the combination of an inclined trough, a deck or false bottom carried by said trough, an adjustable bed at the lower end of said trough, means for imparting a conveying motion to said trough in the direction of its higher end, a perforated feed tray located above the trough, adapted to deliver material passing through its perforations directly to said trough, means for imparting a conveying motion to said feed tray in the opposite direction to that of the trough, and a series of water pipes between the feed tray and the deck of the trough for giving a series of graded streams of water on to the deck of the trough.

2. In a machine for washing materials of a granular or like nature, the combination of an inclined trough having a dish-shaped lower end, an adjustable bed or bottom to said lower end, means for adjusting the level of said bed, a deck or false bottom carried by said trough and having its lower end in such proximity to the bed of the trough that it will always be submerged in the water held up in the lower end of the trough, means for imparting a conveying motion to the trough in the direction of its upper end, a perforated feed tray located above the trough, adapted to deliver material passing through its perforations directly to said trough, means for imparting a conveying motion to said feed tray in the opposite direction to that of the trough, a series of water deliveries located between the feed tray and the deck of the trough, and means for grading the flows from said deliveries.

3. In a machine for washing materials of

a granular or like nature, the combination of an inclined trough having an adjustable dish-shaped lower end, means for adjusting the level of the bed of said lower end of  
5 trough, riffles on the deck or false bottom, means for imparting a conveying motion to the trough in the direction of its upper end, a feed tray having a series of graded perforations through which material is adapted to  
10 pass directly to said trough, means for imparting a conveying motion to said feed tray in the opposite direction to that of the trough, a series of transversely arranged water delivery pipes located between the  
15 feed tray and the trough, and means for varying the volume of water flowing from said pipes.

4. In a machine for washing materials of a granular or like nature, the combination of  
20 an inclined trough having an adjustable dish-shaped lower end, means for adjusting the level of the bed of said lower end of trough, a deck or false bottom carried by said trough and having a set-down lower  
25 end, riffles on the deck or false bottom, means for imparting a conveying motion to the trough in the direction of its upper end, a feed tray having a series of graded perforations through which material is adapted  
30 to pass directly to said trough, means for imparting a conveying motion to said feed tray in the opposite direction to that of the trough, a series of transversely arranged water delivery pipes located between the  
35 feed tray and the deck of the trough, and

means for varying the volume of water flowing from each of said pipes.

5. A coal washing and separating machine comprising an inclined trough having a false bottom, means for imparting a recip- 40  
rocal motion to said trough, a perforated feed tray carried by said trough adapted to deliver material to said trough, means carried by said trough for imparting motion to  
45 said tray in a reverse direction to that of said trough, adjustable water feeds disposed between said tray and trough for delivering water upon the bottom of said trough, and a receptacle carried by said trough for receiving the overflow from the lower end of 50  
said trough.

6. A coal washing and separating machine comprising an inclined trough having riffles on the bed thereof and a reduced end portion, means for adjusting the level of said 55  
end portion means for imparting a reciprocal motion to said trough, a perforated feed tray carried by said trough, means carried by said trough for imparting motion to  
60 said tray in a reverse direction to that of said trough, and adjustable water feeds disposed between said tray and trough for delivering water upon the bottom of said trough.

In testimony whereof I affix my signature 65  
in the presence of two witnesses.

R. SEYMOUR BENSON.

Witnesses:

JNO. S. SHORT,  
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