April 13, 1926. 1,580,728

E. HODEIGE

COMBINED WASHING AND SORTING APPARATUS

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Fig. 1.

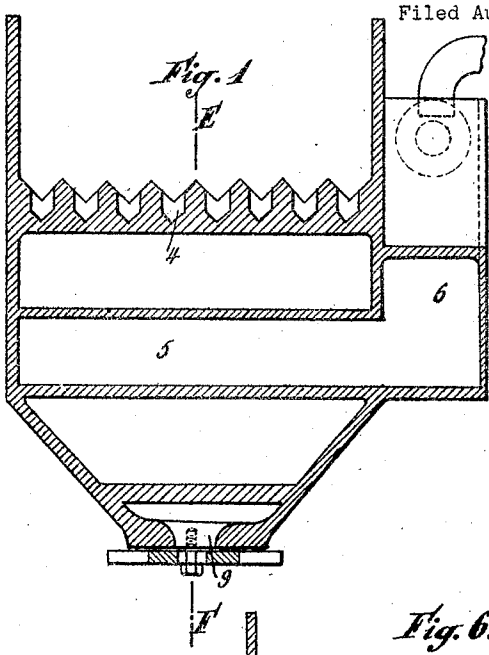


Fig. 3.

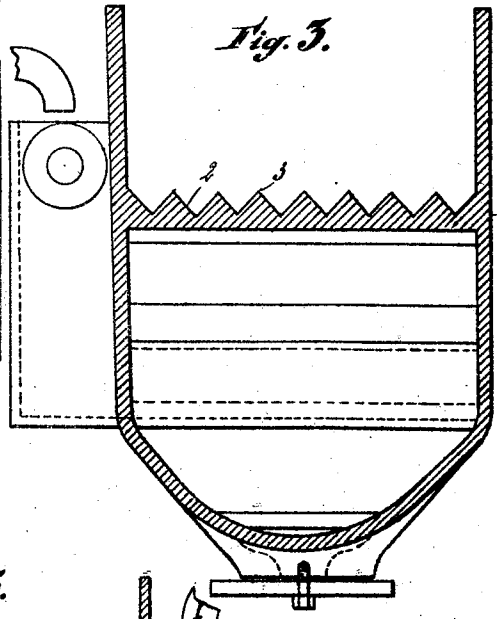


Fig. 6.

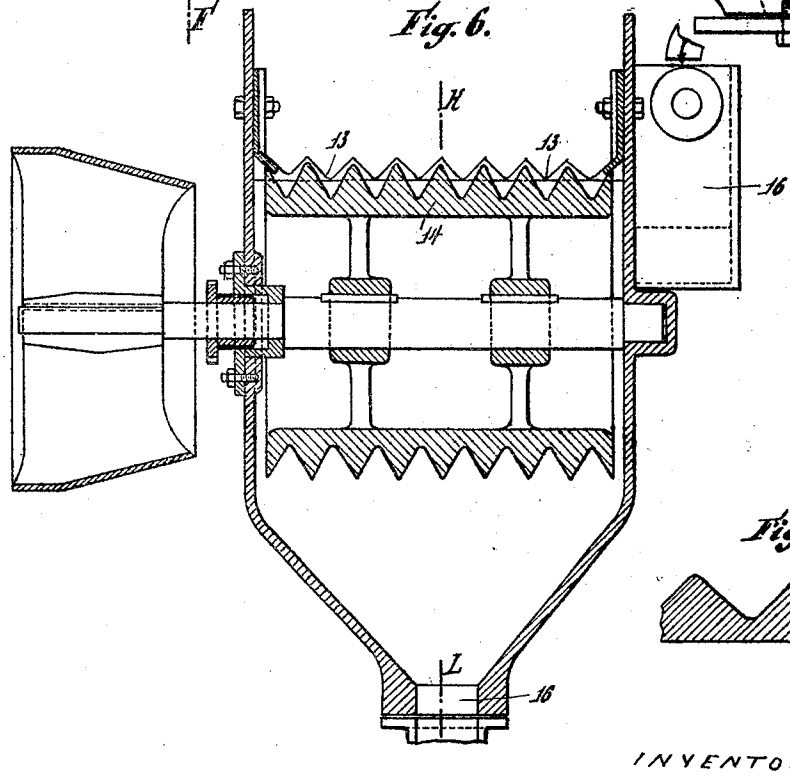


Fig. 5.



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Fig. 2.

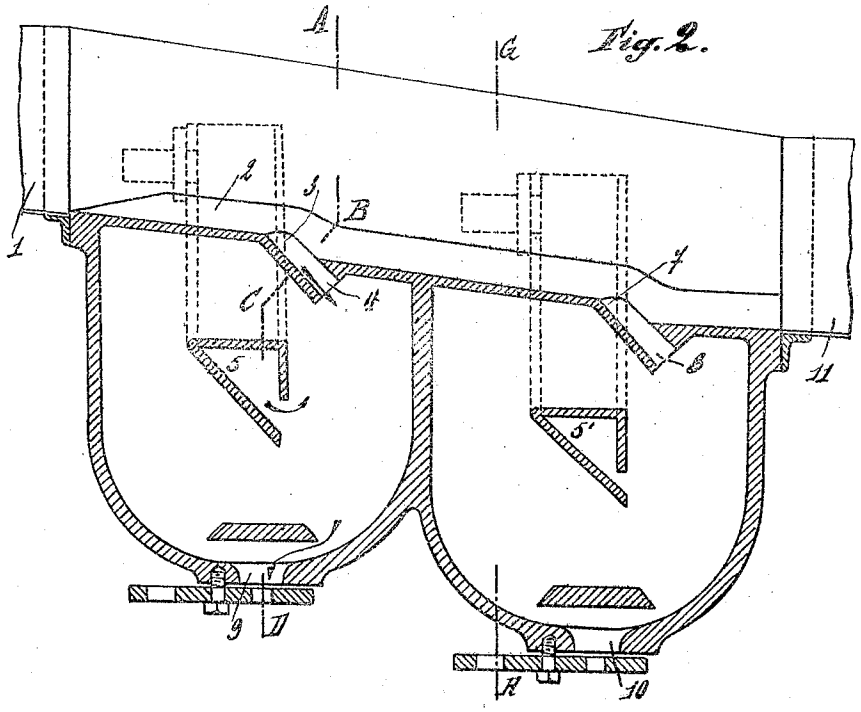
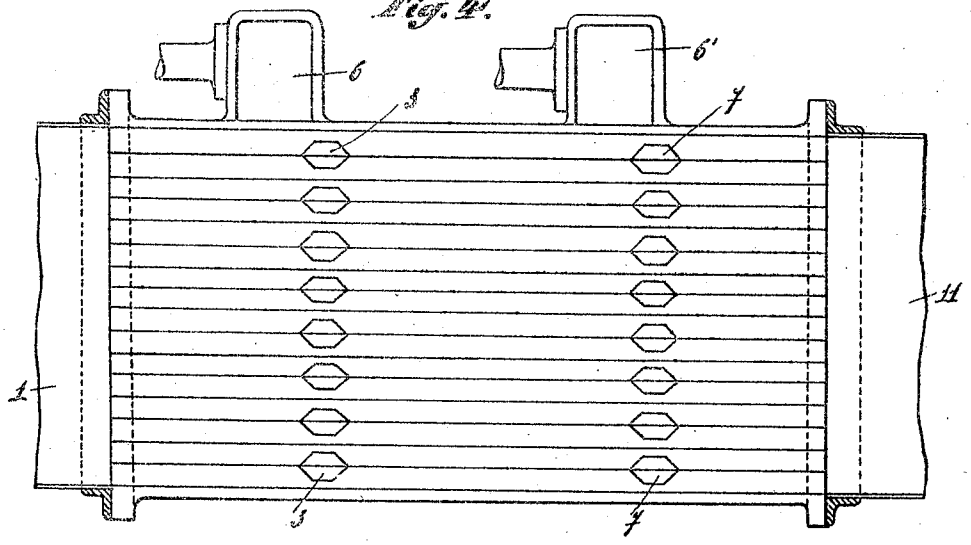


Fig. 4.



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Fig. 7.

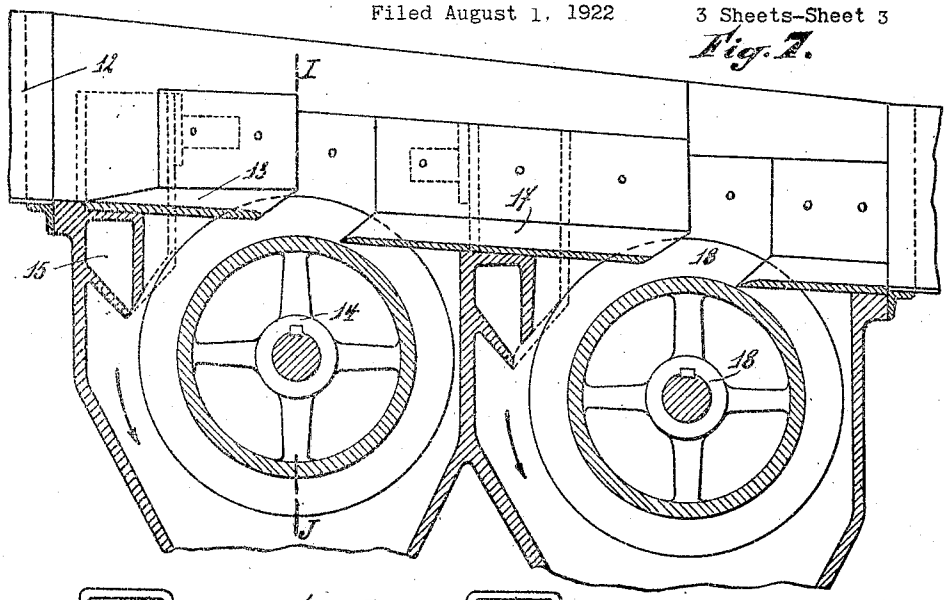
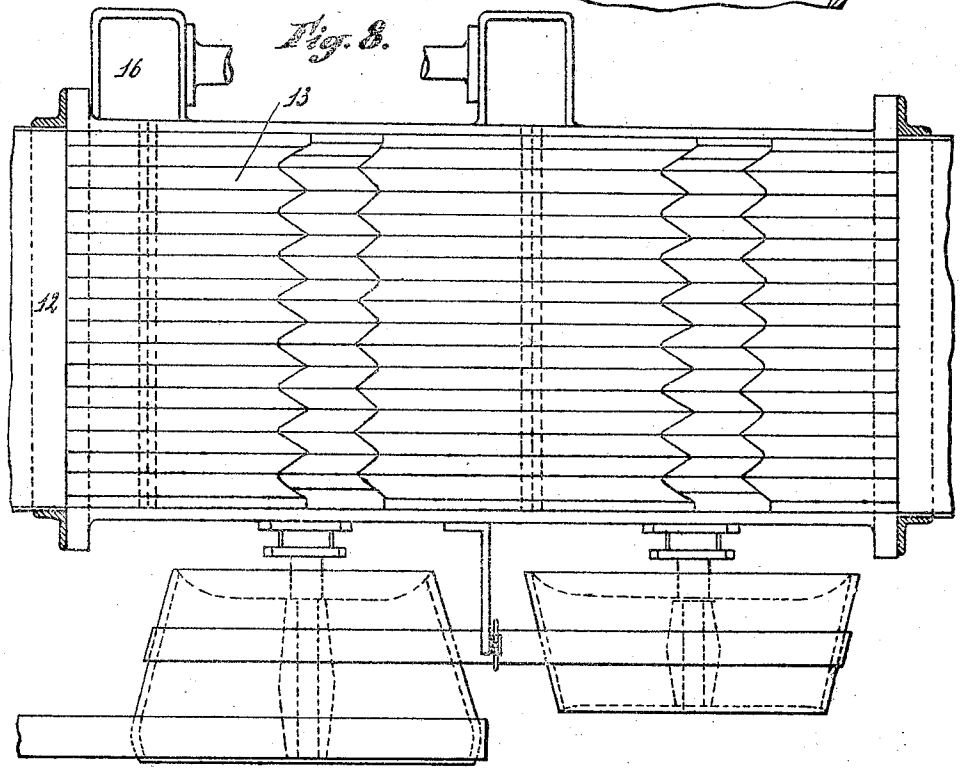


Fig. 8.



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Patented Apr. 13, 1926. 1,580,728

UNITED STATES PATENT OFFICE.

ERNEST HODEIGE, OF JEMEPPE-SUR-MEUSE, BELGIUM, ASSIGNOR TO EVENCE COPPEE & CO., OF BRUSSELS, BELGIUM.

COMBINED WASHING AND SORTING APPARATUS.

Application filed August 1, 1922. Serial No. 578,911.

To all whom it may concern:

Be it known that I, ERNEST HODEIGE, subject of Belgium, residing at Jemeppe-sur-Meuse, Belgium, have invented new and useful Improvements in Combined Washing and Sorting Apparatus, of which the following is a specification.

The present invention is intended for the washing, that is to say for the sorting of coals or minerals according to specific gravity, previously assorted according to volume.

This sorting according to specific gravity is based principally on the action of friction produced between a current of water and the walls of a duct having longitudinal grooves, parallel to the direction of flow. These grooves being in the form of gullet teeth in cross section, have the property of voluntarily increasing, owing ta their contours, the frictional action, towards their bottoms, on the moving liquid particles and of increasing the thickness of the liquid layer above that of a like volume delivered at an equal mean speed.

The actual speed of flow is, for this reason, much greater towards the free or upper surface of a layer than at the bottom, where, owing to the shape of the grooves, it is subjected to the full retarding action due to friction, this phenomenon being much more amplified than in an ordinary flat-bottomed duct.

The larger particles of the liquid flowing along the grooved duct are, for this reason, carried along in a stream or current much more rapid than that of the small particles which are conveyed along nearer the bottom of the grooves.

The speed of the particles of the liquid stream is, therefore, proportional to the size of the latter. Now, it is known that the carrying force which is dependent on the weight—which resists removal—is likewise proportional to the size of a particle. If there is equality between the ratios (speed to size and carrying force to size) there will be equilibrium between the effect produced by the liquid flow on the particle encountered and the resistance of the latter to movement, since these two forces are antagonistic.

In an ordinary flat bottomed duct the friction is insufficient to produce the differences in speed applied to different particles and necessary to balance completely the influence of size in the resisting factor.

The grooved duct has the immediate effect of voluntarily increasing the action of friction on the particles in movement, because the friction surface is increased therein. By suitably shaping the grooves it will be possible to adjust the friction to some extent so as to eliminate the effect of size in grading by the carrying speed and to make this grading solely dependent on specific gravity.

There will, then, be different carrying speeds for particles of different specific gravity. The densest particles will be carried less rapidly, while the less dense ones, having a greater carrying speed, must pass over the former, which have a retarded speed due to the action of the grooves and thus form a veritable bed of schists advancing slowly along the duct.

The presence of these grooves will also have the result of producing an increase in the thickness of the bed of schists, which will facilitate the removal thereof. Openings for this purpose are provided and disposed conveniently and in sufficient number towards the bottom of the grooves, so that it will be possible to separate the particles urged towards the bottom from the particles nearer the top of the layer, thereby effecting a proper sorting according to specific gravity.

Apparatus utilizing these properties is shown in the accompanying drawings, in which:—

Fig. 1 is a cross section along A, B, C, D in Fig. 2.

Fig. 2 is a longitudinal section along E—F in Fig. 1.

Fig. 3 is a cross section along G—H in Fig. 2.

Fig. 4 is a view in plan.

Fig. 5 is a section of some grooves to an enlarged scale.

Fig. 6 is a cross section along I—J, Fig. 7.

Fig. 7 is a longitudinal section along K—L, Fig. 6.

Fig. 8 shows a view in plan of Fig. 7.

The apparatus in Figs. 1–4 is operatively connected to the duct 1, which is either flat-bottomed or grooved according to circumstances, and by which arrives the material to be washed, the material being carried along by means of a current of water which is suitably regulated and has a constant velocity. The apparatus comprises a double trough, one, the lower, being more or less

pointed and the upper one, 2, grooved along its bottom, as shown in Figs. 3 and 5.

Grooves, having a form with somewhat sharp edges (Fig. 3) are used for washing small pieces, while for lumps undulated grooves are preferably used.

The flowing current of water (coming from the duct 1), duly encounters the conditions claimed for the application of the aforesaid principle.

The thickness of the layer will, therefore, be constituted by means of zones of speed that increases proportionally more and more as the zones recede from the bottom of the grooves towards the free surface.

The particles carried along by the current will adopt therein a speed depending solely on specific gravity and inversely proportional thereto. The more dense particles will advance slowly; those of a less density, advancing more rapidly, will be forced towards the top of the layer and the sorting will, therefore, be effected by speed and in layers.

In the bottom of the grooves are inclined openings 3 where there is a drop of a very limited height. From the openings 3 at the bottom of the grooves branch off other grooves 4 forming a duct which has a steep slope, and permits the descent of schists having a certain density, in spite of the action of a counter-current of water mounting this passage 4. The counter-current, coming from a conduit 5, is regulated by means of the trough 6 with constant discharge, but this may be varied at will by increasing or diminishing the height of the stream. Thus the grooves of the duct 4 permit the discharge only of particles having a density above that desired. If desirable, a double system of openings 3 with grooves 4 may be arranged.

Worthless particles can also be separated from the valuable ones, the latter,—coming from a layer located higher up and possessing a greater speed—undergo a fall which carries them beyond the openings 3 in line with the grooved duct 2 which is continued at a slightly lower level. The sorting proceeds beyond these openings and a fresh separation of the lower layer may take place in the same manner by the openings 7 and the duct with sloping grooves 8.

The eliminated products then drop towards the bottom of the pointed troughs at 9 and 10, where they are discharged by a current of water or by any other usual device. The particles, sufficiently valuable if coal be in question, continue their travel by the duct 11 and are conveyed to where it is desired to deposit them.

Several similar apparatus can be placed in series along the path of the coal to be washed; this will naturally depend on the qualities of the product in the raw state.

Figs. 6, 7, and 8 show an application of the preceding method of sorting to apparatus commonly called Frue Vanners, the layer free from schist being here omitted and leaving only a drum which is then grooved and intended for the direct discharge of the refuse where coal is being washed.

The product to be washed, arriving by means of a current of water from the channel 12, enters the apparatus in which is arranged a grooved duct 13. The grooves of duct 13 are less pronounced and are opposite to and above the grooves of a drum 14 which is given a circular rotary movement in a direction opposite that of the current and as indicated by the arrow.

The product arriving in current of water in the duct 13 drops on to the grooved drum where it receives, in addition to the impetus imparted to it by the current which conveys it, an impetus from a current of water arriving from a duct 15 fed constantly from a trough 16.

The particles of greater density, by virture of the preceding principle, have a retarded speed in the grooves of the drum relatively to that of the particles of weaker density, which produces a sorting. The result is that the particles, the carrying speed of which is lower than the rotary speed of the drum as also those which remain adherent thereto, are conducted along by the drum and, becoming detached, drop down to be discharged through the opening 16.

The products having a higher speed of travel are taken up again by another set of grooves 17 conforming exactly to the contours of the drum and a second separation is obtained by a like operation by means of a second grooved drum 18.

The products sufficiently dressed continue their travel and are conducted towards the loading device provided.

For the purpose of enabling the quality of the product obtained to be varied, two methods of control may here be put in operation: (1) by altering the speed of the currents of water at the points 12 and 15, by providing a charge of water variable at will; (2) by altering at will the speed of rotation of one of the two drums by smooth cones or by stepped pulleys.

Having thus described the nature of the said invention and the best means I know of carrying the same into practical effect, I claim:—

1. Washing apparatus comprising a duct composed of side walls and a bottom, the bottom being provided with a transverse series of longitudinal grooves of substantially uniform cross sectional area and having side walls converging sharply toward the bottom of the grooves to automatically increase the friction of the flow from the top to the bottom of the grooves, said duct being

provided with openings, for each grooves, branched ducts also having sharply angular grooves therein, located beneath the said openings and having a greater inclination than the first mentioned duct, means for directing a fluid longitudinally of the main duct and grooves whereby the material to be washed is propelled along the same so that material of greater density settles to the bottom of the grooves due to gravity and friction, troughs beneath the openings to receive the more dense material therefrom, means within the troughs for directing a counter current of fluid along said branch ducts, whereby material of lesser density will be prevented from passing through the openings.

2. Washing apparatus comprising a duct adapted to receive material to be washed and the washing fluid and directing the same longitudinally thereof, the said duct being composed of side walls and a bottom and provided in the bottom with a transverse series of longitudinal grooves of relatively sharp angularity of substantially uniform cross sectional area, the side walls of which grooves converge downwardly toward the bottoms thereof whereby friction on the material to be washed is automatically and proportionately increased as the material settles towards the bottom of the grooves, the said ducts having openings therein to permit discharge of the denser particles therethrough, means for directing a counterflow of fluid through the openings, and means also provided with angular grooves adjacent said openings for assisting discharge of the denser material through the openings in opposition to the counterflow fluid while preventing discharge of material of less specific gravity through the openings.

In testimony whereof I hereunto affix my signature.

ERNEST HODEIGE.