This invention relates to the separation of particles of different densities by means of liquids.

It is particularly directed to the cleaning of "coal" but it is not limited thereto.

The invention will principally be described with reference to the cleaning of coal, this usually being effected by pneumatic separation on tables which may be stationary or moving.

The object of the present invention is to provide an improved or modified method.

The invention consists in a method for the separation of particles of different densities by means of liquids particularly for the cleaning of coal according to which the mixture is first treated with a protecting liquid comprising oil or other substances which will minimize the wetting of the solid material by the high density liquid and the thus treated material then submitted to the action of a liquid of density intermediate between that of the coal or other material to be concentrated and the associated refuse or material to be separated therefrom.

The invention also consists in methods for the separation of particles of different densities by means of liquids substantially as herein described.

In carrying the invention into effect in one form by way of example applied to the cleaning of coal, I first treat the material with oil or the like in the form of a fine spray or mist and next submit it to the action of a solution having a density greater than coal but less than stone, and preferably having high surface tension so that the pretreated particles are not unduly wetted when immersed in the solution.

Suitable separating liquids are solutions of calcium chloride or zinc chloride.

As to the pretreatment of the mixture to be separated, paraffin oil forms a convenient substance which may be applied by spraying, this being preferably carried out while the material is being fed to the tanks containing the liquids, on a bar screen, so that the whole of the surface can be covered with the spray.

In carrying this process into effect any suitable apparatus may be used, the following by way of example:

The raw product is delivered by means of a travelling bar screen, or the like, so that the whole of the surface of the particle is available for spraying, past the oil sprays, and into the tank containing the separating liquid. Here the light particles float and the heavy ones sink, whence they may be removed by any suitable mechanical means whereby the high density liquid is not removed along with the solid particles.

Any suitable means may be provided whereby accumulations of sludge may be tapped off from the bottom of the tanks as occasion demands. If necessary, the treated particles may be sprayed with water to remove traces of adhering heavy density liquid.

General.

By means of the present invention a simple method is provided for the cleaning of coal and the like enabling larger pieces of material to be treated than those which are usually treated with the pneumatic separating processes or with such processes as the ore froth flotation processes.

The invention is particularly useful in connection with particles from the size of 1" cube upwards.

It is preferred to work with a liquid of density not less than about 1.7 when the cleaning of coal comes into question, but the densities of the particles to be separated must be borne in mind. Generally speaking coal has a specific gravity less than about 1.35. There is usually a certain amount of intergrown material with density between about 1.35 and about 1.75 and some heavy high ash refuse may be present having a density higher than about 1.75.

In the case of anthracite the density of the reasonably pure material may be as high as about 1.9.

As an alternative to the spray treatment of the coal by paraffin oil, a layer of paraffin oil, or the like may be floated on the surface of the high density liquid so that the coal must pass through the paraffin, or the like, before it reaches the high density liquid. As
a result of this preliminary treatment, the high density liquid does not wet the surface of the coal, but runs off in globules and is very largely recovered, thus overcoming two undesirable features, viz:—

1. The loss of high density liquid, which must be kept low if the process is to be sufficiently economical to be worked commercially, and

2. The adherence to the coal of large quantities of liquid, large quantities being objectionable as they would spoil the appearance of the coal and have several other objections.

The smaller the particles treated, the greater the amount of surface per unit weight there will be which must be covered in the first place by the oil reagent, and the greater the loss of high density liquid.

The invention, therefore, is particularly suitable for the separation of large particles of stone from large particles of coal, that is to say, material which is usually separated by hand-picking.

The invention provides a mechanical process for the treatment of large coal whereby the labor normally employed in hand-picking the refuse is eliminated.

In a form of the invention, which is particularly applicable to coals containing a high percentage of material of intermediate density, two liquid media of different densities may be employed, and one of the products from the first tank re-treated in the second liquid.

Before the coal is subjected to the action of the first liquid it is treated with oil or other substances which will minimize the wetting of the solid material by the high density liquid.

In addition to the treatment with oil or other substances which will minimize the wetting of the solid material by the high density liquid before the coal or other material to be concentrated is subjected to the first liquid medium a second treatment with oil or other substances which will minimize the wetting of the solid material by the high density liquid may be applied after the coal or other material to be concentrated has been subjected to the first liquid medium and before it is subjected to the action of the second liquid medium.

For example, a coal may contain 70% by weight of its particles lighter than 1.4 specific gravity with an ash content of 5%, 20% by weight of its particles with a density between 1.4 and 1.7 and having an ash content of 90%; and 10% by weight of its particles having densities higher than 1.7 and having an ash content of 70%, that is to say, consisting practically of pure shale.

With such a coal, after the coal has been subjected to the action of oil or other substances which will minimize the wetting of the solid material by the high density liquid the first treatment in a liquid medium may be in the liquid of 1.4 density, so that only 90% of the input to the first stage need be re-treated in the second stage at 1.7 density. The resulting products containing 5, 20, and 70% of ash respectively may be marketed as regards the first two as first class coal and second class coal, and the third product discarded as worthless.

In such cases as offer economical advantages, the second product may be broken down to a smaller size to liberate the intergrown layers of coal and stone, and such crushed product may be treated by this or any other process.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A process of separating a material having solid constituents of different specific gravities; comprising water-proofing by means of oily substances of the material containing a high proportion of valuable constituents and being highly adsorptive of water and aqueous saline solutions, floating off said valuable constituents on a saline solution of specific gravity intermediate that of the valuable and waste constituents, and draining the water-proofed valuable constituents to yield a dry concentrate free from water and saline solution.

2. A process of separating a material having solid constituents of different specific gravities; comprising water-proofing by means of oily substances of the material containing a high proportion of valuable constituents and being highly adsorptive of water and aqueous saline solutions, floating off said valuable constituents on a saline solution of specific gravity intermediate that of the valuable and waste constituents, and draining the water-proofed valuable constituents to yield a dry concentrate free from water and saline solution, the size of the particles treated being from about 1-inch cube upwards.

In testimony whereof I have signed my name to this specification.

COLIN WILLIAM HIGHLAND HOLMES.