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T. M. CHANCE
METHOD AND APPARATUS FOR DETECTING ACCUMULATIONS OF
MATERIALS IN COAL WASHERS AND ORE CONCENTRATORS
Filed Aug. 5, 1924

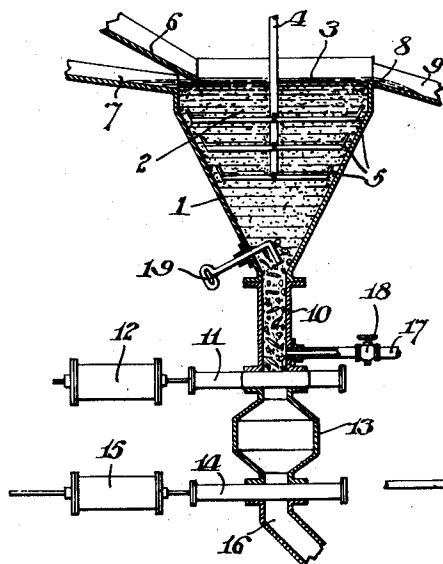


FIG. I.

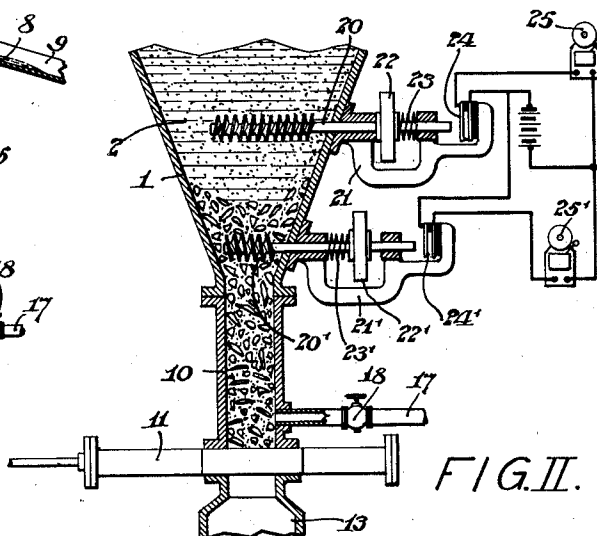


FIG. II.

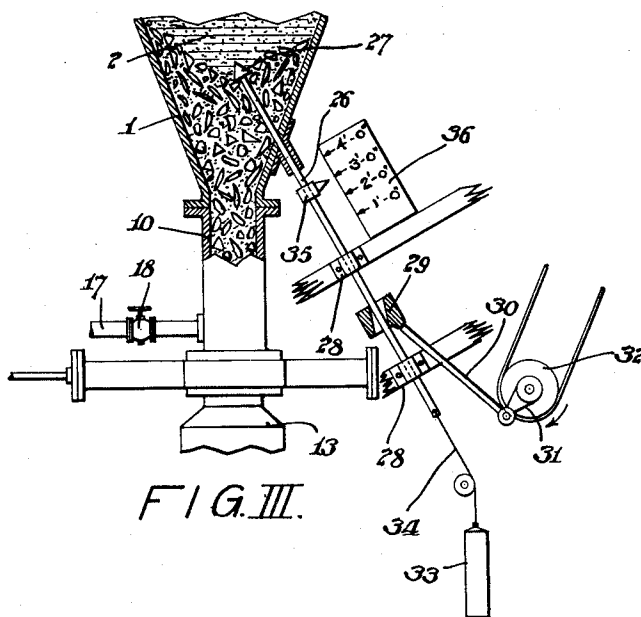


FIG. III.

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METHOD AND APPARATUS FOR DETECTING ACCUMULATIONS OF MATERIALS IN COAL WASHERS AND ORE CONCENTRATORS.

Application filed August 5, 1924. Serial No. 730,160.

My invention relates to the operation of coal washers, ore concentrators and the like in which separation is effected by the sinking of the heavier materials through a liquid and particularly through a separating liquid medium of the type I have described as a "fluid mass" in Patent No. 1,224,138 issued May 1, 1917, No. 1,392,399 issued October 4, 1921 and No. 1,462,881 issued July 24, 1923, and is especially directed to such devices in which the heavier materials are periodically, intermittently or continuously removed from the bottom or lower part of the apparatus at predetermined intervals or at intervals determined by the accumulation of said materials.

The principal objects of my invention are to provide a means whereby the amount of such accumulations or the accumulation of materials at a faster rate than their rate of removal may be detected or indicated, so that it may be possible either to retain any predetermined quantity of such accumulated materials in the lower part of the apparatus, or to insure its removal at a rate that will prevent such accumulation. Other objects of my invention are to provide a separating apparatus of the type contemplated, with means whereby the accumulation of materials at a rate faster than the rate of their removal may be automatically detected and indicated, said means being cooperative with the accumulated materials to effect the actuation of visible or audible signalling devices, and may be independently or cooperatively associated with recording registering appliances and with means arranged to effect the retention and discharge of said accumulated materials.

The most simple form of apparatus for carrying out my invention consists of a detector rod or shaft extending into the separating receptacle containing said fluid mass and so mounted as to be readily movable to engage with accumulations of materials, whereby the presence of accumulated material may be indicated or detected by the resistance to movement of the detector that such accumulation affords. Such detector rod may preferably be provided with an arm, or may be bent or provided with one or more wings or projections through the resistance to the movement of which the presence of

accumulations of solid materials can be detected or indicated with certainty.

Such detector may be so mounted in a bearing in the wall of the receptacle, as to be readily rotated, gyrated, revolved, reciprocated or otherwise actuated in said bearing, that portion of the rod inside the receptacle preferably being provided by a projection which upon contact with solid materials will offer resistance to rotation, gyration or reciprocation, but such projection is not essential if the rod is to be operated solely by reciprocation. It will be understood that any deflection of the rod from a straight line, as a bending of a portion of the rod, is the equivalent of a projection in resisting movement. Such detectors can be operated by hand, but in many cases it will be desirable to operate them mechanically and to operatively connect them to gongs, annunciator systems, visual indicators, recording registers to record the presence of an accumulation of said materials, and to means for controlling the removal of the accumulated materials so that the apparatus automatically controls the quantity of accumulated materials permitted to remain in the lower part of the separator.

My invention also includes all of the various novel features of construction and arrangement as hereinafter more definitely specified.

In the drawings, Fig. I is a vertical cross-section and elevation of a separator or concentrator of the inverted cone type, showing my invention in its most simple form, consisting of an indicator or detector so mounted that it can be reciprocated, oscillated or revolved by hand. Fig. II is an enlarged vertical cross-section of a portion of the separator shown by Fig. I showing a pair of detectors arranged to automatically indicate the presence of a large quantity of accumulated materials or the absence of such accumulations. Fig. III is a similar enlargement of a portion of Fig. I and illustrates the use of a single reciprocating detector to indicate the presence and quantity of such accumulations.

The mechanical construction of apparatus whereby my invention may be operated can be greatly varied by those skilled in the art of constructing automatic indicating, annunciator, registering and control appliances.

Continuous recording apparatus may be operatively connected to any mechanically operated form of apparatus used in carrying out my invention and a record obtained of the height of accumulated materials in the separator covering any desired period. The gong or annunciator may be replaced by or supplemented by a visual indicator, these being used separately or jointly, and with or without recording devices, or with or without means operatively connected to control the removal of the heavier materials from the separator.

The drawing Fig. I shows the general assembly of elements in a type of coal separator used at some of the anthracite coal mines in Pennsylvania, in which 1 is the separating tank or receptacle containing a fluid mass 2 with a superposed body of water 3, a revolving agitator shaft 4, carrying agitator arms 5, a feed chute 6, a chute 7 for returning sand and water to the tank 1, a discharge weir 8 and chute with desanding and dewatering screen 9, an extension of tank 1 in the form of a pipe or conduit 10, upper discharge slide valve 11 operated by thrust cylinder 12, a refuse chamber 13, a lower discharge slide valve 14 operated by thrust cylinder 15 and a refuse chute 16. Water under pressure for agitating the fluid mass 2 is admitted from pipe 17 through control valve 18 to the lower part of the pipe or conduit 10.

The drawing shows one of the most simple forms of detector as a rod 19 bent in the form of a letter L and passing through an opening in the lower part of the cone. It is provided with a handle, may be given a reciprocating or rotating motion by hand, and affords a simple and efficient means for detecting the presence of accumulations of the heavier materials that have sunk through the fluid mass, such accumulations being recognized by the resistance they offer to movement of the detector 19. By connecting the handle of the detector 19 to movable and suitable rods, links, cords, chains, or the like, the detector may be operated from any desired point.

In Fig. II detectors in the form of slowly revolving screws are illustrated which operate by the thrust on the screw to make or break an electric annunciator circuit, the screw or threaded shaft 20 revolvably and slidably mounted in the bearings and bracket 21 carries a pulley 22 or gear by which it is slowly revolved. In the absence of an accumulation of solids in contact with the screw of shaft 20 the shaft is held in place by the spring 23 but if solid material accumulates in contact with the screw the spring 23 is compressed and the shaft 20 moves to the right closing the electric circuit through circuit breaker 24 and actuating annunciator system 25. The action of the lower detector 20' is the reverse of that described, the presence of an accumulation of materials in con-

tact with the screw being to compress spring 23', keeping the circuit open so long as such accumulation is present, but upon its absence or removal the spring 23' moves shaft 20' to the right completing the circuit through 24' and 25'.

In Fig. III the detector is a rod 26 having an enlargement on its upper end shown as a conical head 27. The rod is supported in bearings 28, 28 and is periodically pushed upwardly by the clutch 29 which is rigidly attached to connecting rod 30 and is reciprocated by crank 31 driven in the direction indicated by the arrow by the pulley 32. The connecting rod 30 is made of elastic material so that it may yield slightly by bending and thus prevent the sharp binding edges of clutch 29 from cutting into the metal of detector rod 26. The detector rod is thus pushed upwardly through a portion of the up stroke of connecting rod 30, while during the balance of the said upstroke and during the down stroke of connecting rod 30 the clutch 29 does not bind or hold detector rod 26 which is thus free to fall under by its own weight and any additional force such as a spring or weight 33 operatively connected to 26 by a cord or chain 34. The presence of an accumulation of materials below the head or enlargement 27 prevents the detector rod from falling, and the depth of the accumulation of materials is therefore shown by the position of the pointer 35 attached to rod 26, with reference to the indicator scale 36.

It is evident that two or more detectors of the described type can be used to detect the presence of larger or smaller quantities of such accumulated materials more accurately than can be indicated by a single detector.

I do not limit myself to the specific forms, precise details or types of apparatus shown by the drawings as these are intended to illustrate diagrammatically variations in the construction of the essential elements of my invention as herein described and claimed.

Having described my invention, I claim:

1. A method of separating materials of different specific gravities which consists in immersing said materials in an agitated mixture of liquid with comminuted solids heavier than said liquid and substantially insoluble therein and constituting a fluid mass having a specific gravity intermediate the heavier and lighter of said materials, in introducing liquid under pressure through an accumulation of said heavier materials below said fluid mass, whereby said fluid is agitated by said upwardly rising liquid and its fluidic properties and its specific gravity are maintained and controlled, in supplying a source of energy extraneous to said accumulations, in applying a force of predetermined intensity in counteracting said energy, in applying said energy so counteracted to said accumulation,

whereby the presence of said accumulation is indicated by its resistance to said energy, in indicating the locus of application of said force by said resistance, in downwardly removing some of said accumulation when the quantity of said accumulation exceeds a predetermined maximum and in limiting the quantity of said accumulation so removed, whereby a predetermined quantity of said accumulation is maintained below said fluid mass.

2. Apparatus for separating materials of different specific gravities comprising a receptacle adapted to contain an agitated mixture of liquid and solids heavier than the lighter of said materials and constituting a fluid mass of specific gravity intermediate the heavier and lighter of said materials, a fluid mass of the described type in said receptacle, means for introducing liquid under pressure at a point located below the base of said receptacle, means for applying a force to an accumulation of the heavier materials below the said fluid mass, means for applying a predetermined resistance to said force, said means comprising an element in operative relation to said accumulation and in operative relation to said restraining means, means for indicating the location of the point at which the resistance of said accumulation tends to restrain further movement of said element,

means for downwardly removing said accumulation, and means for limiting the quantity of material so removed.

3. Apparatus for separating materials of different specific gravities comprising a receptacle adapted to contain an agitated mixture of liquid and solids heavier than the lighter of said materials and constituting a fluid mass of specific gravity intermediate the heavier and lighter of said materials, a fluid mass of the described type in said receptacle, means for introducing liquid under pressure at a point located below the base of said receptacle, means for applying a force to an accumulation of the heavier materials below the said fluid mass, means for applying a predetermined force partially to counteract said force, said means comprising a continuously moving element in the lower part of said receptacle adapted to be moved by the resistance of said accumulations, means for indicating such movement of said element, whereby the presence or absence of said accumulations at the locus of said element is indicated, means for downwardly removing said accumulations and means for limiting the quantity of said accumulations so removed.

Signed at Philadelphia, in the State of Pennsylvania this 4th day of August, 1924.

THOMAS M. CHANCE.