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STRUCTURE OF THE TECHNOLOGICAL COMPLEX

The mobile technological complex consists of three main principally new devices : a rotary hydraulic (hydrodynamic) mill (RGDM), a multicommodity multi-product hydrocluster (CIM) and centrifugal concentrators (CCC).

The hydrodynamic mill (MHD) is a kind of rotary hydraulic cavitation mill, designed for finely grinding various materials of any strength and abrasiveness. The mill can provide grinding of granular material to a size of 0.1 microns (a characteristic feature - the thinner the grinding of the raw material is required, the more effectively the hydrodynamic mill operates), and also for mixing various liquids, liquids with gas and solid materials.

Experimental-industrial tests of a mill with a productivity of ~ 100 t / h have confirmed the high efficiency of grinding. At the same time, it became necessary to increase the wear resistance of the mill units. This problem was solved by the method of electropulse hardening of the working surfaces of the mill and the use of special polymeric and metallic nanopowder materials.

The technical and economic comparison of the rotary hydraulic cavitation mill (RHCM) with serially produced domestic and foreign vibro-ball mills indicates that the rotary hydraulic mill with the same degree of grinding is almost five times less than the energy consumed per 1 ton of the raw material . Its mass is 30-90 times, and its dimensions are 7-10 times smaller than in the best vibro-ball mills. In addition, the new mill easily fits into the technological line for hydraulic processing of granular materials, since it can suck in and pump up the original pulp to a height of up to 20 m or more.

Multicommodity shelf hydroclassifier (CGS) provides effective separation of various granular materials at any size and density, including fine particles, as well as productive and quality enrichment and separation of such materials by fractions with different granulometric and chemical compositions of the incoming slurry.

As a result of studying the process of precipitation of suspended grains of minerals in laminar flows, it was possible to separate fine-grained materials with relatively high accuracy, and also to brighten the polluted waters.

The dependence of the distribution of various components of the slurry (noble and heavy metal ores, mercury-containing components, and other toxic products) on the zones of MGC is established. The distribution is determined by calculation, allowing to establish a qualitative-quantitative plot of precipitation of various components in different zones of multi-product hydroclassifier.

The enlarged characteristics of shelf thickeners-hydroclassifiers of different firms are given in Table. 2. Advantages of a shelf thickener-thickener: own weight and production cost are reduced by 1.7-2.0 times, and the simplicity of the design allows it to be manufactured in small workshops. The latter is achieved due to the transverse (horizontal) flow direction in the interlam space, when the liquid phase of the pulp-flows perpendicular to the direction of the sediment movement.

Table. 2 Comparative data of shelf thickeners of hydroassifiers

Characteristic, indicator	Form-developer (manufacturer)			
	Ecoresources Hydrotechnics	Uralmashobr	Research Institute Hydromechanism	Denver (USA)
Output by initial pulp, m3 / h	165	165	165	165
Total mass, t	12.0	24.0	28.0	23.5
Overall height, m	3.0	6.0	9.0	11.1
Cost of production, thousand rubles.	400	780	840	1600
Laminarization ofthe flow (liquidation of the counterflow)	stream laminarity	missing	missing	stream laminarity
Flow direction	horizontal	vertical	vertical	combo

The horizontal arrangement of the thickener with several bunker discharges of condensed products compared to vertical single-bunker designs of shelf thickeners made it possible to reduce the overall overall height of the apparatus by 1.5-2 or more times.

Centrifugal concentrator gives off heavy metals, incl. And mercury containing, as well as gold and platinoids from technogenic wastes (tailings) of concentrating plants. With this method, extraction of heavy metals, incl. Mercury-containing and precious metals, from tailings will be 95-99%. After the recovery of heavy metals, it is possible to use waste as building materials and, in particular, as a backing material for underground mining. Land that has been freed from the tailings, after reclamation, can be used for farmland, construction and other areas of economic development.

The proposed technology makes it possible to use environmentally friendly solvents for the transfer of precious metals into the ionic form and to extract them on selective ion-exchange filters having a fiber base. It is also promising to use ceramic filters.

The proposed technological complex and the equipment included in it have no analogues in the world practice of hydraulic processing of granular materials due to their efficiency, low material intensity and cost. The novelty of technical solutions is protected by more than ten author's certificates of inventions and patents.

The technological complex works as follows (рис.1): waste (tails) from the tailings (tailing dump) are transported (2) by road (3) to the receiving hopper through the grate screen, which releases inclusions of fineness +50 mm. Sand from the bunker with the help of a belt feeder and a tray (4) is fed to the vibrating screen (6), mounted above the sump (7). Pulp preparation is carried out by supplying technical water to a tray, a vibrating screen and a sump in a volume of 3-4 m^3 / t of the starting product. The oversized product of the vibrating screen (+2 mm ... 50 mm) is fed by a conveyor (5) belt to the storage area, and the sub-product (-2 mm ... +0 mm) from the sump in the form of a slurry flows through the suction nozzle into the cavitation hydrodynamic rotor mill (8). Here, grinding (dispersing) occurs, the disclosure of fine-grained materials due to high-intensity hydrodynamic impacts and cavitation.

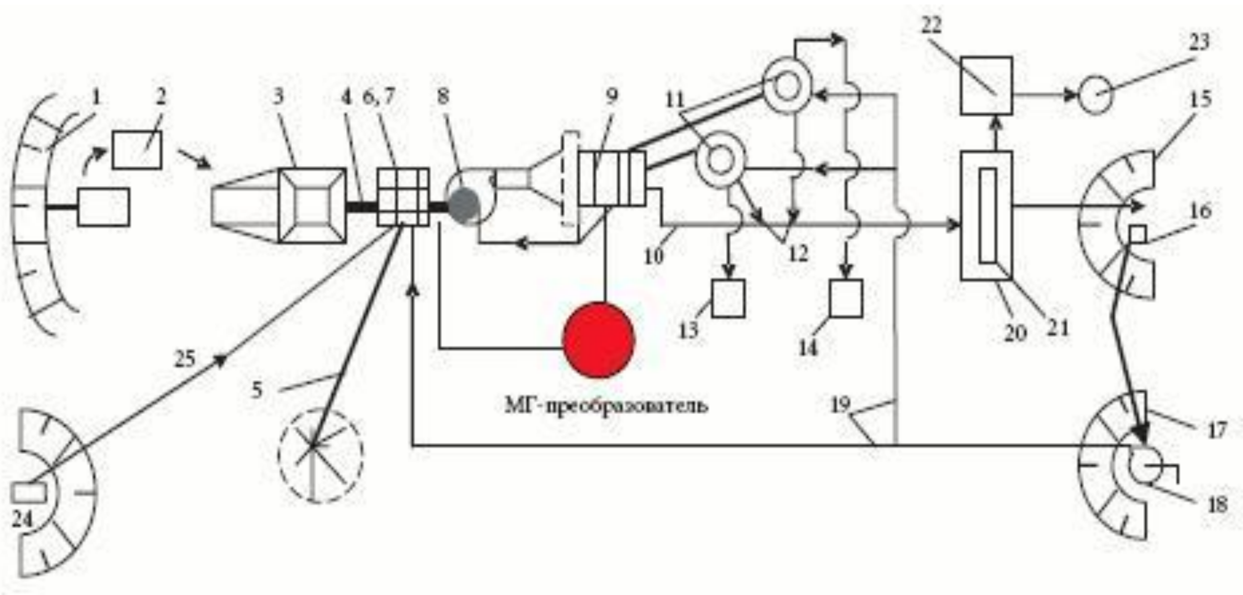

Fig. 1 Diagram of connections of devices of an autonomous mobile technological complex for processing and utilization of technogenic and natural-technogenic deposits

The destruction of the intergrowths of the minerals of heavy metals (Cu, Zn, Pb, Kd, Se, etc.) in noble metals (gold, platinum, palladium, silver) with quartz and other minerals occurs on weaker metal contacts with nonmetals Effect of Rebinder), which to a large extent facilitates the removal from the tails of RP of mercury, heavy metal toxins and precious metals.

From the mill, the pulp is sent to multi-product hydrocracker (MGC) (9), where the stream is laminated in a labyrinth of parallel plates and is divided into fractions characterized by the density and granulometric composition of the granular material that settle on inclined surfaces made of special material (lamellas). The fractions (+0.2 mm ... 2.0 mm) are separated in the first compartment of the hydroclassifier, which are sent to a hydrodynamic mill for re-grinding by a vibrating screen (6). In subsequent sections, minerals, heavy metals, mercury, harmful components are released, Cu, Zn, Pb and others.

In the lower storage chambers of MGC (9), precious metals and heavy metals, as well as other ores, are enriched to a concentration of 10 times or more from the initial (1st stage). Further (up to 80%), most of the pulp with dissolved toxins, radionuclides and other fine dispersible harmful inclusions through the drain pipe of the hydroclassifier is sent to the thin-layer settler (20). From the accumulating lower chambers of the hydroclassifier, the enriched slurry of minerals is sent to the second stage of enrichment in concentrators (11), in which the degree of concentration of metals increases by 2-3 orders of magnitude (for example, 2-3 kg / t of the starting product in gold with an annual concentrate output of 8-20 Tons).

From the concentrators (11), the bulk of the pulp in the form of an obsolete product, the yield of which is more than 90%, with the toxins and radionuclides dissolved in it through the fixed drainage boxes and the waste pulpwood (10) is sent to the thin-layer settler (20) with the coagulator (21). In the settling tank the slurry with finely dispersed particles (less than 5-40 microns) is condensed with the help of coagulator to the state Т: Ж = 1: 1. The condensed fine suspension with demilitarized products sent to the storage card – blade (15), which has a dumping well (16). Clarified water with dissolved toxins and radionuclides is sent to the radionuclide and toxin (22) release unit, after which they are sent to the respective disposal facilities of radioactive waste and toxins (23). Purified from fine particles and harmful impurities, the technical water from the well enters the sedimentation pond (17), from where it comes from a circulating water pump (18).

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