

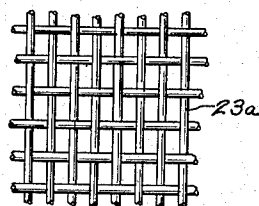
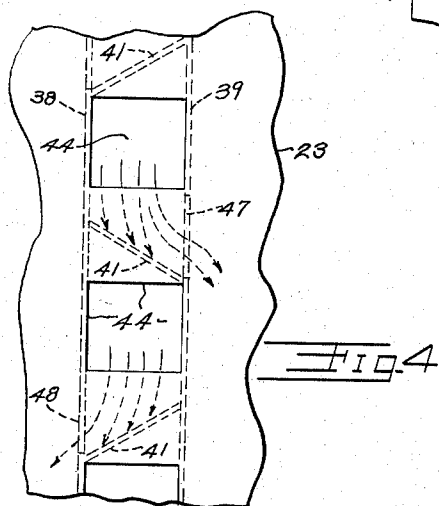
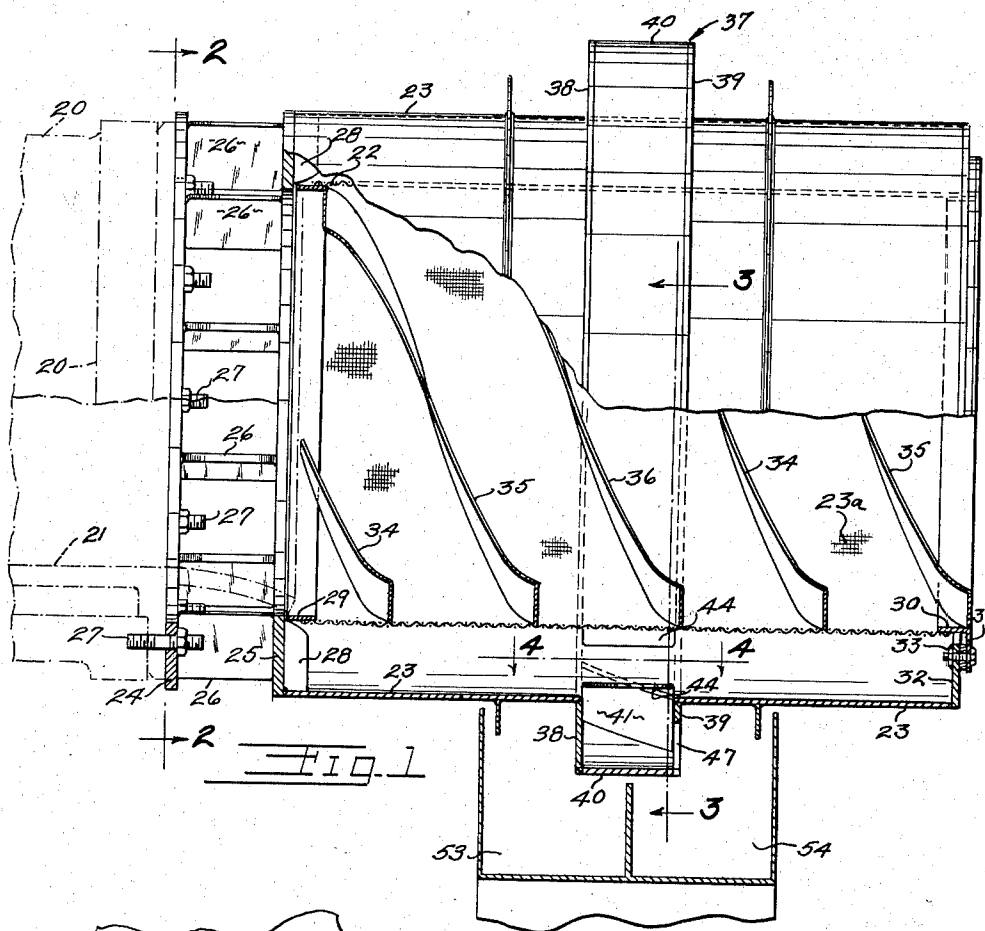
Jan. 27, 1959

I. H. WYNNE
PULP SPLITTER

2,870,909

Filed Feb. 5, 1957

2 Sheets-Sheet 1



INVENTOR.
IRA H. WYNNE

BY
Hyde, Meyer, Baldwin & Doran
ATTORNEYS

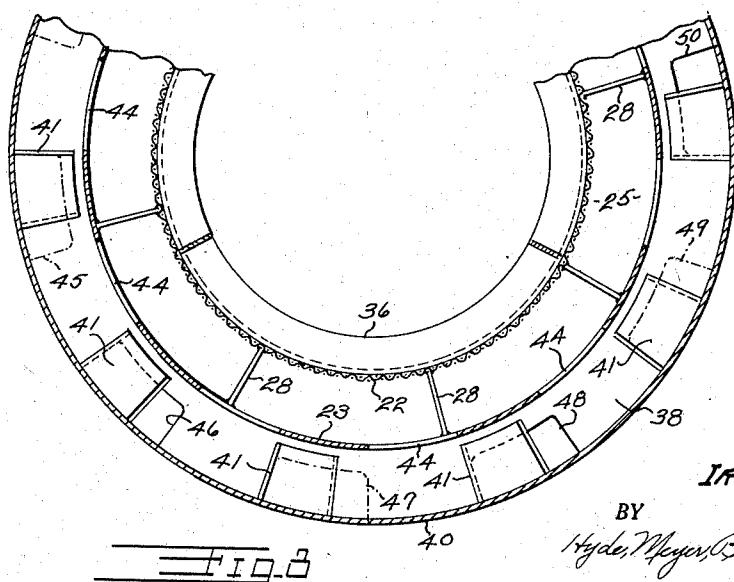
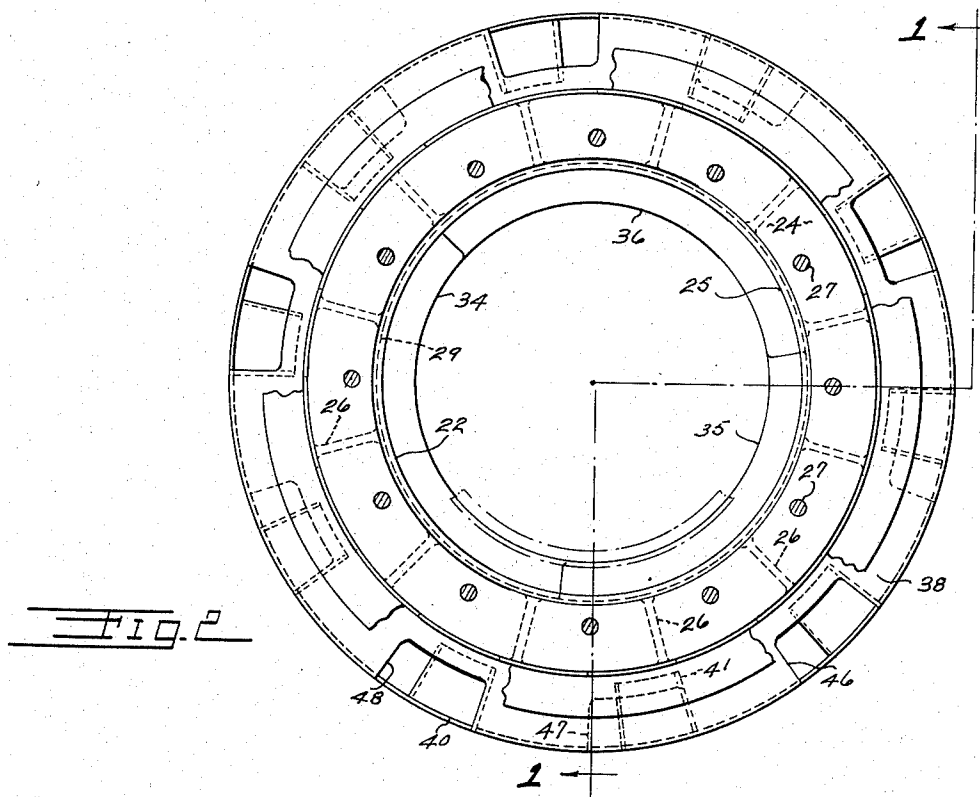
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PULP SPLITTER

Ira H. Wynne, San Francisco, Calif., assignor to Reserve Mining Company, Silver Bay, Minn., a corporation of Minnesota

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6 Claims. (Cl. 209—284)

The invention relates to a novel and improved device for the reception of a stream of particles, either dry or in liquid slurry or pulp, and for splitting said stream into two distinctly diverging streams of identical physical characteristics, which streams can be diverted to further processing devices.

By way of illustration, and not of limitation, the invention will be described with reference to a step in the beneficiation of ores wherein ground material is received from a grinding mill, screened to provide particles less than a predetermined maximum size, and divided into two diverging streams which proceed to further grinding and/or magnetic separation steps. The latter steps are, of course, utilizable only when a fraction of the ground ore has magnetic characteristics, as in the case of the ferrous metal ore known as taconite.

In the treating of taconite, for example, the normal beneficiation steps include crushing of the rock from the mine, followed by a number of stages of coarse and fine grinding with intermediate separation steps including liquid washing and magnetic separation. In a continuous process of this nature it is desirable that the progressively refined material be advanced from each succeeding step to the next on conveyors which have a downward gradient so that gravity is substituted for a certain proportion of the total power expenditure, thereby effecting a substantial eventual saving in power costs.

Further, in such beneficiation process, the volumetric capacities of individual processing units diminishes with refinement of individual steps, so that whereas a coarse crushing unit may turn out tons of crushed ore per minute, the output of a fine grinding mill or a magnetic separator may be measured in pounds per minute. Obviously therefore, to maintain a process in which all units operate continuously, the material being ground must be split at times into several channels, proceeding to identical processing units. As a practical example the output of a single rod mill, in one typical grinding sequence, must be diverted to a pair of ball mills, operating not in sequence but in parallel, in order to keep the granular mixture or slurry moving. Rather than do this in an interrupted batch process, it is highly desirable to split the material continuously so as to provide two streams of identical analysis and particle size, and when the stream is an aqueous pulp or slurry, two streams of identical pulp density. This is desirable because commercial success of the entire process is dependent to a great extent on careful control of all factors, including controlled homogeneity of the physical and chemical characteristics of the material being processed.

While therefore the present invention will be described with occasional reference to use in a process requiring grinding units in series, the apparatus is also applicable to other processes wherein comminuted material is being divided into two streams of preferably identical characteristics.

An object of the invention is to provide novel, improved, and efficient apparatus for splitting a moving

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stream of granular material, dry or in an aqueous pulp slurry, into two streams of similar physical characteristics.

A further object of the invention is to provide apparatus of the type defined in the last preceding paragraph wherein, in a continuously downwardly moving series of steps, the splitting is accomplished with only a minor loss in elevation.

Other objects and advantages will be apparent from a study of the following specification, in conjunction with the accompanying drawings, showing one embodiment of the invention, in which:

Fig. 1 is a view, partly in side elevation and partly in section, showing a pulp splitter embodying this invention.

Figs. 2, 3 and 4 are sectional views taken respectively on the lines 2—2, 3—3, and 4—4 of Fig. 1.

Fig. 5 is a plan view of the screening material used in conjunction with the invention.

The embodiment of the invention shown in the drawings is used in conjunction with a rod mill, the discharge end of which is indicated by the broken lines 20 at the left of Fig. 1, the discharge spout of the rod mill being shown at 21. The device which splits the pulp from the rod mill comprises an inner cylinder 22 and an outer cylinder 23, the inner cylinder wall being formed from screen material 23a (Fig. 5) which in the present instance has mesh openings approximately $\frac{3}{8}$ " by $\frac{3}{4}$ ".

Mutual connection between these cylinders, and attachment of the assembly to the rod mill is effected as follows. At the left end of the pulp splitter is a connecting collar comprising the two rings 24 and 25 which are held rigidly together by a circumferential series of plates 26. The ring 24 is attached to the ball mill by studs 27. The ring 25 is welded to outer cylinder 23 and on the inner face of this ring 25 are a series of lugs 28 which support a collar 29 to which the inner cylinder 22 is attached. The right end of cylinder 22 is similarly attached to a collar 30 which has an outturned flange 31 connected by bolts 33 to a ring 32 carried by cylinder 23. It will be apparent that the pulp splitter can be separated from the rod mill by removing the nuts from studs 27, and that the inner screen cylinder 22 can be removed from the outer cylinder 23 by removing the nuts from bolts 33 and withdrawing the inner cylinder laterally to the right.

Along the inner periphery of cylinder 22 there are arranged a series of helical ribs projecting inwardly and arranged in compound thread fashion, parts of three "flights" being shown respectively at 34, 35 and 36. It will be noted that the integral continuation of flight 35, at the right lower end of Fig. 1, appears again at the lower left of center. The pulp splitter is fixedly attached to the rod mill and rotates with it, and consequently the ground material discharged from the rod mill in an aqueous slurry, proceeds to the right over spout 21 (Fig. 1) and falls on the screen wall 22, whence it is impelled to the right by screw flight ribs 34, 35 and 36. In its passage the smaller lumps and particles fall through the screen wall of cylinder 22 into the lower part of the annular space between cylinders 22 and 23. The particles which are too large to pass through the screen are discharged at the right end and may be recirculated to the rod mill.

Centrally disposed around the outer cylindrical wall 23 is an annulus or channel 37 having two radially projecting parallel walls 38 and 39 and a peripheral wall 40. This annular channel is divided into a plurality of segments by a respective plurality of partitions 41 which extend completely across the channel, and which are angularly inclined to side walls 38 and 39, the angle of inclination being alternately reversed in progressive sequence along the channel as best seen in Fig. 4, for a purpose soon to appear.

The wall 23 of the outer cylinder is provided with a series of peripheral ports 44 (Fig. 3), each port communicating with a respective channel segment, so that as the pulp splitter rotates, the sludge in the annular space between cylinders 22 and 23 falls progressively through each successive port 44 as it passes its lowermost position, and enters the respective segment communicating with each said successive port.

The parallel side walls 38 and 39 are provided with discharge apertures 45, 46, 47, 48, 49, 50, etc. (Fig. 3), there being one aperture to each segment, and the apertures being alternately staggered, right and left in sequence, so that apertures 45, 47 and 49 are in one wall and 46, 48, and 50 in the other wall. For this reason the pulp slurry in alternate segments will discharge in alternate directions as each segment reaches bottom center. While this would operate quite satisfactorily even if partitions 41 were disposed in planes coincident with the axis of rotation, they are inclined to promote discharge flow through the openings between them.

As seen in Fig. 1 there is shown means providing a pair of troughs 53 and 54 which proceed to a respective pair of further processing units, in this case a pair of ball mills, for finer grinding of the pulp. It will be obvious that alternating increments of the pulp are diverted right and left so rapidly that the flow is practically continuous into each trough and the physical and chemical characteristics of the split streams are uniform. Troughs 53 and 54 are shown only in section since further illustration thereof is unnecessary, and the arrangement of units with which these troughs are connected is a matter of convenience of unit installation.

What I claim is:

1. Means for receiving a flow of ground material of varying particle sizes and splitting at least a portion of said flow of material into two distinct divergent streams, said means comprising a cylinder into which said material is delivered, said cylinder being rotatable on a substantially horizontal axis, an annular peripheral channel supported on the outer wall of the cylinder and bounded by a pair of outwardly projecting side walls, and a bottom wall carried thereby enclosing the space between the side walls, a plurality of partitions extending across said channel at respectively spaced locations whereby to divide said channel into a plurality of segments, said cylinder wall being provided with openings, one opening in registry with each segment, said side walls being provided with discharge apertures, one aperture to each segment, the apertures being alternately staggered, right and left in sequence, whereby, when said cylinder is rotated, material falls by gravity into said segments in turn, and therefrom out of said staggered apertures in alternate sequence.

2. Means for receiving a ground agglomerate of varying particle sizes from a processing device and splitting at least a portion of said agglomerate into two distinct streams diverging to respective further processing devices, said means comprising inner and outer coaxial cylinders fixed with respect to each other and rotatable on their common horizontal axis, said inner cylinder having a mesh screen wall portion, means for moving said agglomerate from one end of said inner cylinder towards the other during rotation of said cylinders whereby at least a part of said agglomerate falls through said mesh screen into the space between the cylinders, an annular peripheral channel supported on the wall of the outer cylinder and bounded by a pair of outwardly projecting parallel side walls, and a bottom wall carried thereby, a plurality of partitions extending across said channel at respectively spaced locations whereby to divide said channel into a plurality of segments, said outer cylinder wall being provided with a ring of spaced ports, one port in registry with each segment, said parallel side walls being provided with discharge apertures, one aperture to each segment, the apertures being alternately staggered, right and left

in sequence, whereby, when said cylinders are rotated, screened material falls by gravity into said segments in turn, and therefrom out of said staggered apertures in alternate sequence.

3. Means for receiving a ground agglomerate of varying particle sizes from a processing device and splitting at least a portion of said agglomerate into two distinct streams diverging to respective further processing devices, said means comprising inner and outer coaxial cylinders fixed with respect to each other and rotatable on their common horizontal axis, said inner cylinder having a mesh screen wall portion, means for moving said agglomerate from one end of said inner cylinder towards the other during rotation of said cylinders whereby at least a part of said agglomerate falls through said mesh screen into the space between the cylinders, an annular peripheral channel supported on the wall of the outer cylinder and bounded by a pair of outwardly projecting parallel side walls, and a bottom wall carried thereby, a plurality of partitions extending across said channel at respectively spaced locations whereby to divide said channel into a plurality of segments, said partitions being angularly inclined to said parallel side walls, said outer cylinder wall being provided with a ring of spaced ports, one port in registry with each segment, said parallel side walls being provided with discharge apertures, one aperture to each segment, the apertures being alternately staggered, right and left in sequence, whereby, when said cylinders are rotated, screened material falls by gravity into said segments in turn, and therefrom alternately out of said staggered apertures in turn.

4. Means for receiving a ground agglomerates of varying particle sizes from a processing device and splitting at least a portion of said agglomerate into two distinct streams diverging to respective further processing devices, said means comprising inner and outer coaxial cylinders fixed with respect to each other and rotatable on their common horizontal axis, said inner cylinder having a mesh screen wall portion, means for moving said agglomerate from one end of said inner cylinder towards the other during rotation of said cylinders whereby at least a part of said agglomerate falls through said mesh screen into the space between the cylinders, an annular peripheral channel supported on the wall of the outer cylinder and bounded by a pair of outwardly projecting parallel side walls, and a bottom wall carried thereby, a plurality of partitions extending across said channel at respectively spaced locations whereby to divide said channel into a plurality of segments, said partitions being angularly inclined to said parallel side walls, the angle of inclination being alternately reversed in progressive sequence along the channel, said outer cylinder wall being provided with a ring of spaced ports, one port in registry with each segment, said parallel side walls being provided with discharge apertures, one aperture to each segment, the apertures being alternately staggered, right and left in sequence, whereby, when said cylinders are rotated, screened material falls by gravity into said segments in turn, and therefrom alternately out of said staggered apertures in turn.

5. Means for receiving a ground agglomerate of varying particle sizes from a processing device and splitting at least a portion of said agglomerate into two distinct streams diverging to respective further processing devices, said means comprising inner and outer coaxial cylinders fixed with respect to each other and rotatable on their common horizontal axis, said inner cylinder having a mesh screen wall portion, means for moving said agglomerate from one end of said inner cylinder towards the other during rotation of said cylinders whereby at least a part of said agglomerate falls through said mesh screen into the space between the cylinders; said last named means consisting of helical flange flights along the inner periphery of said inner cylinder, an annular peripheral channel supported on the wall of the outer

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cylinder and bounded by a pair of outwardly projecting parallel side walls, and a bottom wall carried thereby, a plurality of partitions extending across said channel at respectively spaced locations whereby to divide said channel into a plurality of segments, said outer cylinder wall being provided with a ring of spaced ports, one port in registry with each segment, said parallel side walls being provided with discharge apertures, one aperture to each segment, the apertures being alternately staggered, right and left in sequence, whereby, when said cylinders are rotated, screened material falls by gravity into said segments in turn, and therefrom alternately out of said staggered apertures in turn.

6. Means for receiving a ground agglomerate of varying particle sizes from a processing device and splitting at least a portion of said agglomerate into two distinct streams diverging to respective further processing devices, said means comprising inner and outer coaxial cylinders fixed with respect to each other and rotatable on their common horizontal axis, said inner cylinder having a mesh screen wall portion, means for moving said agglomerate from one end of said inner cylinder towards the other during rotation of said cylinders whereby at least a part of said agglomerate falls through said mesh screen into the space between the cylinders, an annular

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peripheral channel supported on the wall of the outer cylinder and bounded by a pair of outwardly projecting side walls, and a bottom wall carried thereby, a plurality of partitions extending across said channel at respectively spaced locations whereby to divide said channel into a plurality of segments, said outer cylinder wall being provided with a ring of spaced ports, one port in registry with each segment, said side walls being provided with discharge apertures, one aperture to each segment, the apertures being alternately staggered, right and left in sequence, whereby, when said cylinders are rotated, screened material falls by gravity into said segments in turn, and therefrom alternately out of said staggered apertures in turn, and respective receiving means under each said side wall wherein to receive material discharged from said apertures.

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