Dec. 4, 1956 T. L. MYRON 2,772,776

APPARATUS AND METHOD FOR SEPARATING FINES

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Fig. 1.

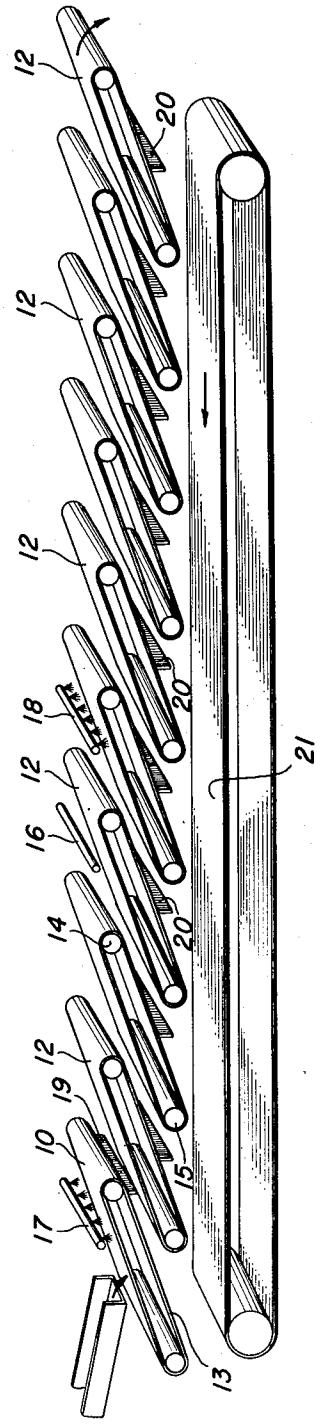
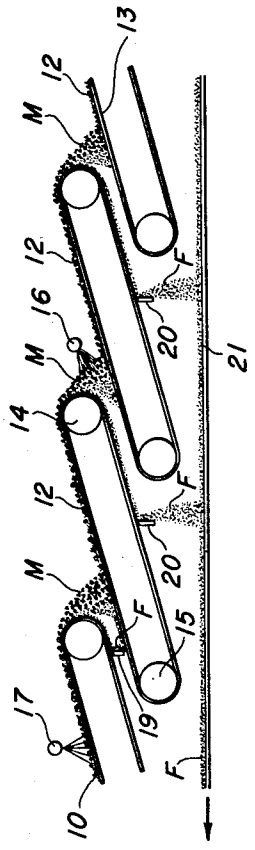


Fig. 2.



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APPARATUS AND METHOD FOR SEPARATING FINES

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8 Claims. (Cl. 209—45)

This invention relates to an improved apparatus and method for separating fines from granular materials.

The presence of fines in granular materials, such as ore, often is objectionable. For example, excessive fines in iron ore charged to a blast furnace make the burden less permeable. Consequently such fines interfere with gas-solid contact, increase coke consumption, and decrease the production rate. The more fines, the greater the dust loss. In practice the most common way of removing fines from iron ore is by screening, which has the disadvantage that it is ineffective with wet, sticky material. The size of screen opening necessarily is rather large, for example 5/8" or 3/4". Thus considerable coarse material is separated as fines, reducing the yield of coarse material, as well as interfering with subsequent sintering of the fines.

An object of my invention is to provide improved and highly efficient apparatus and methods for separating fines from coarser material, which apparatus and methods altogether eliminate screening.

A further object is to provide improved apparatus and methods for separating fines in which moisture does not interfere with the operation, and actually is introduced when not otherwise present in sufficient quantity.

A more specific object is to provide improved apparatus and methods for separating fines in which the feed material is introduced to a series of conveyor belts arranged in tandem, and the material tends to stratify according to size with the fines adjacent the belt surfaces, whereby the fines cling to the belts for removal separately from the coarser fraction.

In accomplishing these and other objects of the invention, I have provided improved details of structure, preferred forms of which are shown in the acompanying drawing, in which:

Figure 1 is a schematic perspective view of an apparatus constructed in accordance with my invention; and

Figure 2 is a side elevational view on a larger scale of a portion of the apparatus illustrating the distribution of particles thereon.

My apparatus comprises a mixing conveyor **10** and a series of separating conveyors **12**, illustrated as nine in number. The conveyors **10** and **12** are of similar construction and each includes an endless belt **13** and a pair of pulleys **14** and **15** around which the belt travels and one of which is power driven. For convenience and to promote compactness, the conveyors **10** and **12** are shown as upwardly inclined, but this feature is not critical to their operation. The conveyors **10** and **12** are arranged in tandem with the discharge end of each (except the last) located over the conveyor which follows it. The upper flights of successive conveyors are spaced vertically a minimum distance of about two feet. The conveyors travel at a fairly rapid speed, for example between 250 and 550 feet per minute.

Granular feed material M, such as ore, is introduced to the upper flight of the mixing conveyor **10** to form a continuous bed approximately a half inch in depth. The

material discharges from the mixing conveyor **10** to the upper flight of the first separating conveyor **12** and thence to each succeeding separating conveyor. When discharging from one conveyor to the next, the material has an appreciable trajectory and a free fall of at least about two feet. This action tends to throw coarser particles farther outwardly than fines and thus to produce a stratified bed on each separating conveyor **12** in which the fines are laid down adjacent the belt surfaces. The tendency of the material to stratify can be enhanced by directing air jets downwardly and backwardly against the falling material. I have shown an air manifold **16** beyond the second separating conveyor in Figure 1 and beyond the first separating conveyor in Figure 2, but obviously the number and location of these manifolds can vary to suit conditions. The tendency to stratify also is enhanced by the repeated discharging from one conveyor to another.

The belts **13** are of rubber or equivalent material which is easily wetted. There should be sufficient water in the bed to wet both the belts and the material M thoroughly. If the feed lacks sufficient water for this purpose, it can be introduced separately. I have shown water spray devices **17** and **18** located above the mixing conveyor **10** and the fourth separating conveyor **12** respectively for introducing water to the bed, but obviously the number and location of these spray devices can vary to suit conditions. Wet fines F in contact with the belt surfaces tend to cling thereto and travel to the lower flight of the conveyor, rather than to discharge to the succeeding conveyor. A scraper **19** is supported in contact with the lower flight of the belt **13** of the mixing conveyor **10** and its downward projection preferably lies over the first separating conveyor **12**. I prefer not to make any size separation between the mixing conveyor and the first separating conveyor, and the scraper **19** merely directs clinging fines to the latter conveyor.

Each of the separating conveyors **12** has a scraper **20** supported in contact with the lower flight of its belt **13** similar to the scraper **19**, except that the downward projections of the scrapers **20** lie ahead of the next separating conveyor. A collecting conveyor **21** for fines is supported underneath the conveyors **10** and **12**. The conveyor **21** also preferably is of the belt type and it travels counter to the conveyors **10** and **12**. The scrapers **20** direct the fines F from the lower flights of the separating conveyors **12** to the fines collecting conveyor **21**. The material which discharges from the last separating conveyor **12** is predominantly a coarse product, while that which discharges from the upper end of the fines collecting conveyor **21** is predominantly fines.

The degree of stratification which the material attains on the conveyors **12** increases with increase in conveyor speed. The amount of fines which cling to the lower flights of these conveyors decreases with increase in conveyor speed. Before fines can cling to the conveyor belts they must of course be placed in contact with the belt surface. Hence the optimum operating speed within the aforementioned range can be determined empirically for any particular material.

While I have shown and described only a single embodiment of the invention, it is apparent that modifications may arise. Therefore, I do not wish to be limited to the disclosure set forth but only by the scope of the appended claims.

I claim:

1. An apparatus for separating fines from wet granular materials comprising a series of power driven belt conveyors arranged in tandem with each spaced a minimum distance of about two feet above the conveyor which follows and having its discharge end located there-

over, whereby material discharging from each conveyor tends to stratify according to size as it falls on the next conveyor, particle removing means mounted adjacent the lower flights of each of said conveyors for removing clinging fines therefrom, the downward projection of at least some of said particle removing means lying ahead of the next conveyor, means for collecting fines removed by said particle removing means, and means situated above and beyond at least one of said conveyors for directing air streams backwardly against material discharging therefrom.

2. An apparatus for separating fines from wet granular materials comprising a mixing conveyor and a series of separating conveyors arranged in tandem with said separating conveyors following said mixing conveyor, said conveyors being of the belt type with each spaced a minimum distance of about two feet above the conveyor which follows and having its discharge end located thereover, whereby material discharging from each conveyor to another tends to stratify on the next conveyor, scrapers mounted adjacent the lower flights of each of said conveyors for removing clinging fines therefrom, the downward projection of the scraper on said mixing conveyor lying over the first of said separating conveyors, the downward projections of the scrapers on said separating conveyors lying ahead of the next conveyor, and means beneath said conveyors for collecting fines removed by said scrapers.

3. An apparatus as defined in claim 2 including means situated above said mixing conveyor for introducing water to the granular material thereon.

4. An apparatus as defined in claim 2 including means situated above and beyond at least one of said conveyors for directing air streams backwardly against material discharging therefrom.

5. An apparatus as defined in claim 2 in which said collecting means for fines includes a belt conveyor located below said mixing and separating conveyors and adapted to travel in a direction counter thereto.

6. A method of separating fines from wet granular material comprising feeding the material to form a moving continuous bed, stratifying the material in said bed to place the fines beneath the coarser fraction, discharging the coarser fraction from the stratified bed to form a second stratified bed of the latter fraction, discharging the coarser fraction from the second bed, and collecting fines which cling to the bed supporting means.

7. A method of separating fines from wet granular material comprising feeding the material to form a moving continuous bed, discharging the material from said bed through a trajectory to form a stratified bed in which the fines are beneath the coarser fraction, discharging the coarser fraction from said stratified bed leaving the fines clinging to the bed supporting means, and scraping the fines from said means.

8. A method of separating fines from wet granular material comprising repeatedly stratifying the material with the fines beneath the coarser fraction, throwing off the coarser fraction after each stratification leaving the fines clinging to the bed supporting means, and separately scraping the fines from said means.

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