Jan. 20, 1925. 1,523,435

A. G. McGREGOR

CRUSHING AND SEPARATING PLANT

Filed May 1, 1923 3 Sheets-Sheet 1

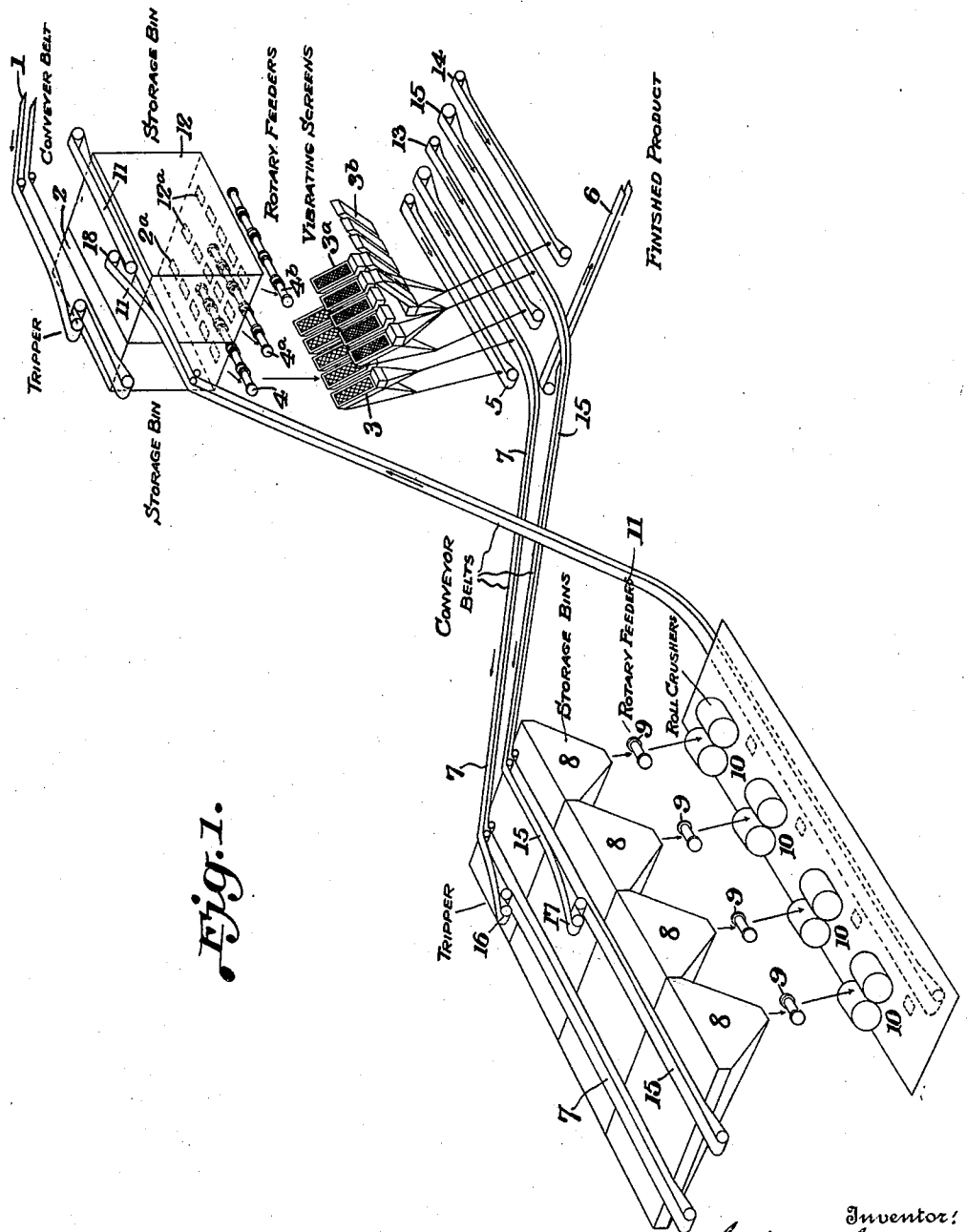


Fig. 1.

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Filed May 1, 1923 3 Sheets-Sheet 2

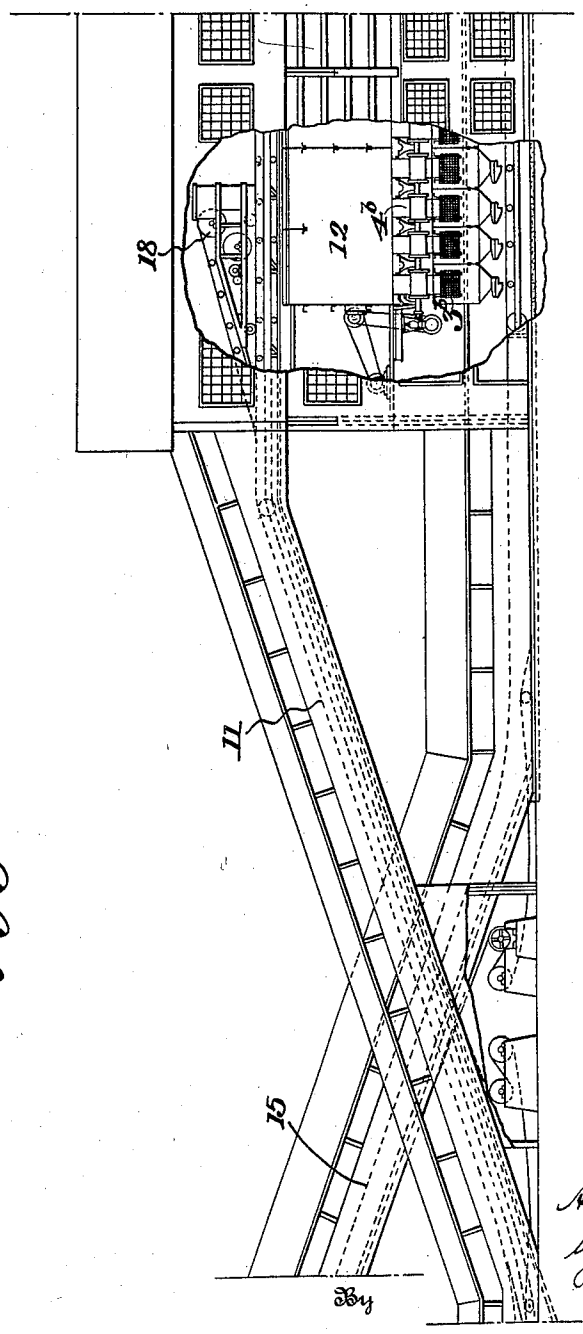


Fig. 2.

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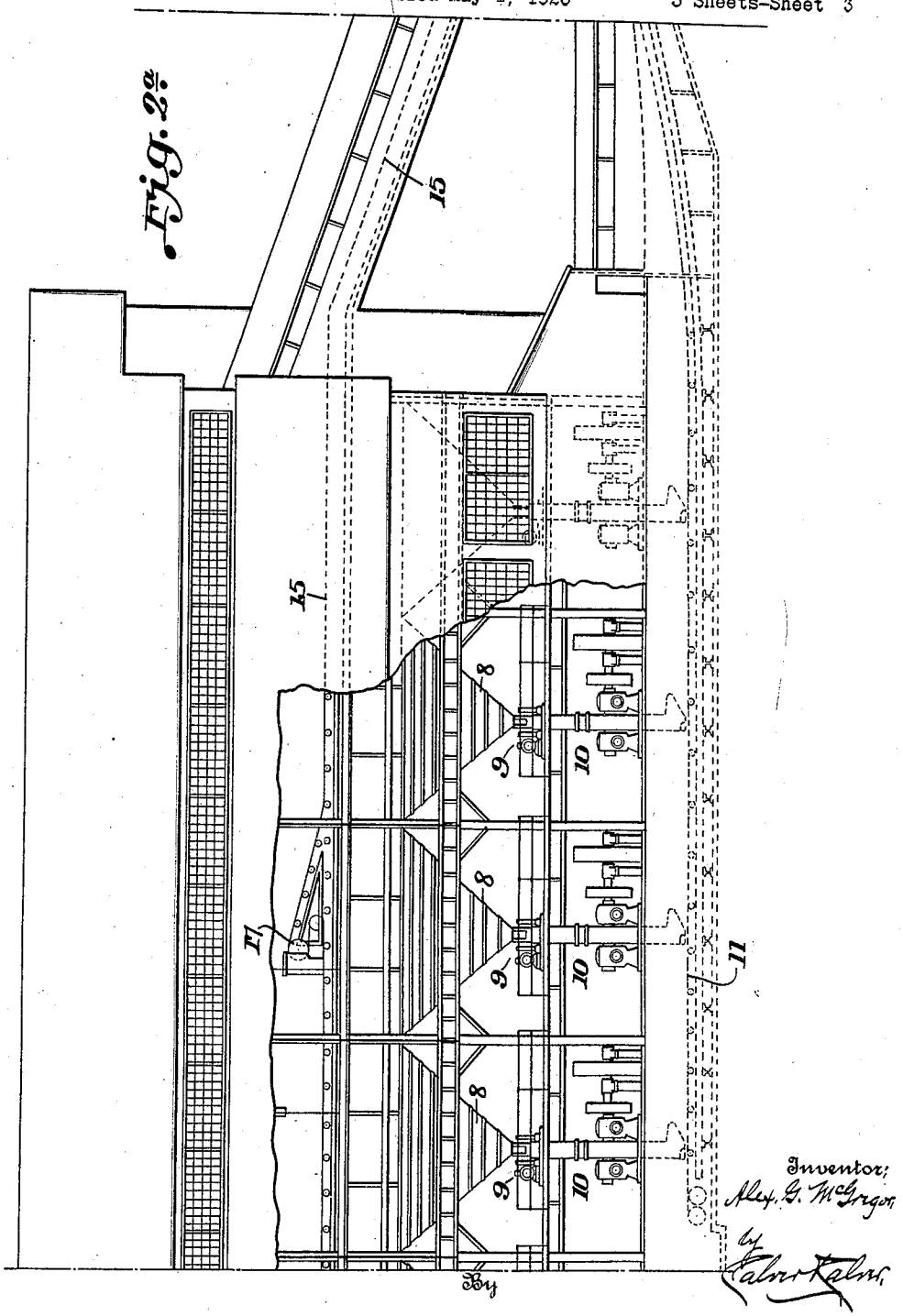
Jan. 20, 1925. 1,523,435

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Fig. 2a.



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UNITED STATES PATENT OFFICE.

ALEXANDER GRANT McGREGOR, OF WARREN, ARIZONA.

CRUSHING AND SEPARATING PLANT.

Application filed May 1, 1923. Serial No. 635,860.

To all whom it may concern:

Be it known that I, ALEXANDER GRANT McGREGOR, a citizen of the United States, residing at Warren, in the county of Cochise and State of Arizona, have invented or discovered certain new and useful Improvements in Crushing and Separating Plants, of which the following is a specification, reference being had therein to the accompanying drawings.

In mills for crushing and separating ores or other similar hard materials, in pulverizing the same, and which employ roller crushing mills, it is common practice in reducing oversize to employ one mill for the first stage or coarse crushing of the oversize and another mill to which the finer oversize from the screens is fed for the second stage or finer crushing, the crushed material from the second mill being then returned to the screens for separation, in securing the finished product. In crushing very hard material the crushing rolls after a time become more or less indented or corrugated thus allowing more oversize to pass through them. For the finer crushing it is important that these corrugations or indentations be kept as small as possible. With the present improved system, when new shells have been placed on a set of rolls that set may be used for the finer crushing until the indentations or corrugations become excessive, when the feed of the material for the coarse crushing may be shifted to such set of rolls, thus allowing the shells of the rolls to be finally worn out in the coarse crushing service. In this way the rolls having the newer shells may be used for the finer crushing, and the rolls having the older shells may be used for the coarser crushing, where the indentations or corrugations are not as great a detriment.

The present invention has for its object to provide a crushing and separating plant or system employing two or more roller crushing mills with means whereby the crushing mills may be employed for one-stage crushing or for two-stage crushing, and when utilized for two-stage crushing either the coarser or finer oversize from the screens may be fed to any desired mill, so that such mill may be used either for the first or coarser crushing of the oversize, or for the second or finer crushing of the oversize, as may be desirable. Thus by means of the present invention the plant may be converted from a two-stage crushing plant to a one-stage crushing plant, and vice versa, with intermediate screening, or may be run as a one-stage crushing plant, without screening, as may be desired, according to the nature or condition of the ores being treated.

In the accompanying drawings Fig. 1 is a diagrammatic view of a crushing and separating system embodying the present invention. Figs. 2 and 2ª are illustrative, in elevation, of the invention.

The material to be reduced by the roller crushing mills is usually first coarsely crushed by jaw crushers or other forms of crushing mills, and such coarsely crushed material may be fed from the coarse crushers by a conveyor 1 to a storage bin 2 having openings 2ª in its bottom through which this crushed material may be fed to the screens or separators 3 by a set of rotary feeders 4 driven in any desired manner. The finer material passing through the screens 3 drops to a conveyor 5 discharging the fine finished product onto a conveyor 6. The oversize from the screens 3 is discharged onto a conveyor 7 by which it is carried to any desired one of several storage bins 8 beneath which are arranged rotary feeders 9 discharging to a set of roller crushing mills 10. The material from the said crushing mills 10 is discharged onto a conveyor 11 by which it is carried to a storage bin 12 having openings 12ª in its bottom for discharging the crushed material to rotary feeders 4ª and 4ᵇ discharging onto screens 3ª and 3ᵇ. The oversize from the screens 3ª and 3ᵇ is discharged onto a conveyor 15 by which it is carried to one of the bins 8 and thence through a rotary feeder 9 to a crushing mill 10. The fine product passing through the screens 3ª falls onto a conveyor 13 and the finished product from the screens 3ᵇ falls onto the conveyor 14, from which conveyors it is discharged onto the finished product conveyor 6. The conveyors referred to are all of the endless belt type.

It will be understood that the oversize from the screens 3 is much coarser than the oversize from the screens 3ª and 3ᵇ. In Fig. 1, diagrammatically illustrating the invention, the coarser oversize material from the screens 3, and carried by the con-

veyor 7, is supposed to be discharged into the first of the bins 8 through the medium of a tripper 16, while the finer oversize material from the screens 3^a and 3^b, will be discharged onto the convenyor 15 which is shown as discharging into the second of the bins 8 by a tripper 17.

These discharging trippers are conventionally represented in Fig. 1, but are of well-known form now in use, and are mounted on wheels so that they may be moved to any desired position over any bin 8, as will be understood from Fig. 2^a in which the tripper 17 is somewhat diagrammatically illustrated, and in Fig. 2 where a tripper 18, discharging into the bin 12, is also shown. By the use of the system of conveyor belts above described and the movable or adjustable trippers 16 and 17, through which said belts run, it will be understood that the coarser oversize material, carried by the conveyor 7, may be discharged into any desired one of the bins 8 and may pass thence to any desired one of the roller crushing mills 10. Also the conveyor 15 may, by the use of a movable or adjustable tripper, as 17, be discharged into any one of the bins 8 and may pass thence to any desired one of the crushing mills 10.

Thus, in two-stage crushing, any one or more of said roller crushing mills in which the shells of the rollers are most worn may be utilized for crushing the coarser oversize material, and in which the corrugations or indentations of the worn shells are not seriously detrimental, while one or more of a set of roller crushing mills, having fresher or less worn shells on the crushing rolls, may be utilized for the finer crushing, as hereinbefore referred to. In other words, any one or more of a row or series of roller crushing mills may be used for the coarser or first crushing, and any one or more of such series of mills may be used for the second or finer crushing. It will thus be apparent that the shells or sleeves of the rolls may be finally worn out in the coarser crushing service, while the mills having the newer or less worn shells may always be utilized for the finer crushing.

In ore reducing plants as now generally arranged it is usual to arrange the roll crushing machines for the coarser material on a certain level or in a room by themselves, while the roll crushing machines for finer crushing are located on a lower level or in another room by themselves. My arrangement as herein shown permits the machines or rolls for coarse and fine crushing to be all arranged in a row side by side so that repairs, etc., may be effected by the assistance of one overhead crane. Also by putting these roll crushing machines all in one room side by side the attendance is much simpler than with the old arrangement.

As hereinbefore stated the present invention permits the plant to be converted from a two-stage crushing plant to a one stage crushing plant, and vice versa, according to the nature of the ores being treated. To convert the two-stage crushing plant herein shown, and operating as above described, into a one-stage crushing plant the movable trippers 16 and 17 may be arranged to discharge into any one of the bins 8 at the same time. In practice, however, in utilizing the plant for one-stage crushing, the said trippers 16 and 17 could be caused to travel automatically back and forth over the bins 8, thus discharging the oversize indiscriminately into said bins which would all contain the same kind of mixture to be fed to the roller mills 10. In one-stage crushing the return conveyor belt 11 will be dispensed with or arranged to discharge to a finished product receptacle or pile.

In handling certain ores which may be sticky and wet from exposure to rain or other causes, it is practically impossible to pass the same through screens and it is more expedient to pass them either once or twice through roller mills without being crushed down to the fixed maximum size. Thus in a known instance a mining company handles an oxide ore which, during the greater part of the year, gives no trouble in crushing and screening, but which, during the rainy season, becomes very sticky and is put through the crushing plant with much difficulty. In handling ores under such conditions the screens 3^a and 3^b may be dispensed with and the crushed ore from bin 2 may be discharged into any or all of the bins 8 by means of the conveyor 7, the ore from the feeders 4 being discharged over screens 3 and onto the conveyor 7, the ore from bin 12 and feeders 4^a and 4^b being discharged onto conveyors 13 and 14.

From the foregoing it will be understood that the invention provides a flexible ore crushing plant which may be operated (*a*) either as a two-stage crushing plant, the final stage crushing mill or mills being in closed circuit with the screens 3^a and 3^b; or (*b*) as a one-stage crushing plant with the crushing mill or mills in closed circuit with the screens 3^a and 3^b; or (*c*) the plant may be operated as a one-stage crushing plant with none of the crushing mills in closed circuit with the screens.

The invention is not to be understood as being limited to any particular details of construction, or to any particular driving mechanism for the different elements and machines employed in this improved system of screens, conveyors, trippers, feeders and roller crushing mills, but the invention will

be understood as residing in the novel arrangement of these elements and machines herein shown and described and by which the object of the invention is effected. The screens 3, 3^a and 3^b, diagrammatically shown in Fig. 1, are, of course, to be vibrating screens of well known form and will be operated in any suitable manner.

Having thus described my invention I claim and desire to secure by Letters Patent:

1. In a crushing and separating plant, the combination with a plurality of sets of screens and a plurality of roller crushing mills, of adjustable means for supplying coarser or smaller oversize material to any desired one of said roller mills, in two-stage crushing, while enabling the plant to be converted into a one-stage plant, if desired.

2. In a crushing and screening plant, the combination of two or more sets of screens and two or more roller crushing mills, of adjustable means for supplying either coarser oversize material or smaller oversize material, or both coarser oversize material and smaller oversize material, to any desired one or more of the said roller crushing mills, thus enabling the plant to be run as a two-stage crushing plant or a one-stage crushing plant in closed circuit, or as a one-stage crushing plant in open circuit, as described, at the will of the operator.

3. In a crushing and separating plant, the combination with two or more sets of screens and two or more roller crushing mills, of adjustable means for supplying either coarser oversize material or smaller oversize material to any one or more of the said roller crushing mills, at the will of the operator.

4. In a crushing and separating plant, the combination with two or more sets of screens and two or more roller crushing mills, of adjustable means for supplying either coarser oversize material or smaller oversize material to any one or more of the said roller crushing mills, at the will of the operator, said supplying means comprising oversize-receiving bins above said mills, bins above said screens for holding coarsely crushed and returned oversize material, conveyors for taking oversize material from said screens to said first-named bins, a conveyor for taking the product from said mills to said oversize bin above the screens, and movable discharging means whereby the coarser or the smaller oversize material may be discharged into any one of the bins above said mills, to be fed to any desired mill or mills.

5. In a crushing and separating plant, the combination with one or more sets of screens and two or more roller crushing mills, of means for supplying either coarser oversize material or smaller oversize material, to any one or more of the said roller crushing mills, at the will of the operator, said supplying means comprising bins above said roller mills, feeders between said bins and mills, bins above said screens, feeders between said last-named bins and said screens, two belt conveyors for carrying the coarser and smaller oversize from said screens to said first-named bins, a belt conveyor for carrying the product discharged from said mills to a bin over said screens, and trippers for discharging the material from said belts into said bins, the trippers above the roller-mill bins being movable so that either the coarser or the smaller oversize material may be discharged into any one of the said bins and so be fed to any desired mill or mills.

6. In a roll crushing and screening plant, the combination with a plurality of sets of roll crushing machines in a row side by side, of adjustable means for supplying coarser or smaller oversize material to any desired machine in said row, accomplishing two stage crushing with rolls set in one row and on the same level.

7. In a roll crushing and screening plant, the combination with a plurality of sets of roll crushing machines in a row side by side, of adjustable means for supplying coarser or smaller oversize material to any desired machine in said row, so that any particular roll crushing machine may be fed with coarse oversize, or finer oversize, for two stage crushing, or any particular machine or machines in said row may be fed with both coarse oversize and fine oversize for one stage crushing.

8. In a roll crushing and screening plant, the combination with a plurality of sets of roll crushing machines in a row side by side, of adjustable means for supplying coarser or smaller oversize material to any desired machine in said row, so that the finer crushing may be done by the machine or machines in said row which are in better condition for the said finer crushing operation.

In testimony whereof I affix my signature.

ALEXANDER GRANT McGREGOR.