Nov. 28, 1950 E. A. WERNER 2,531,798

SUPERPHOSPHATE MANUFACTURING PLANT

Filed July 25, 1946 3 Sheets-Sheet 1

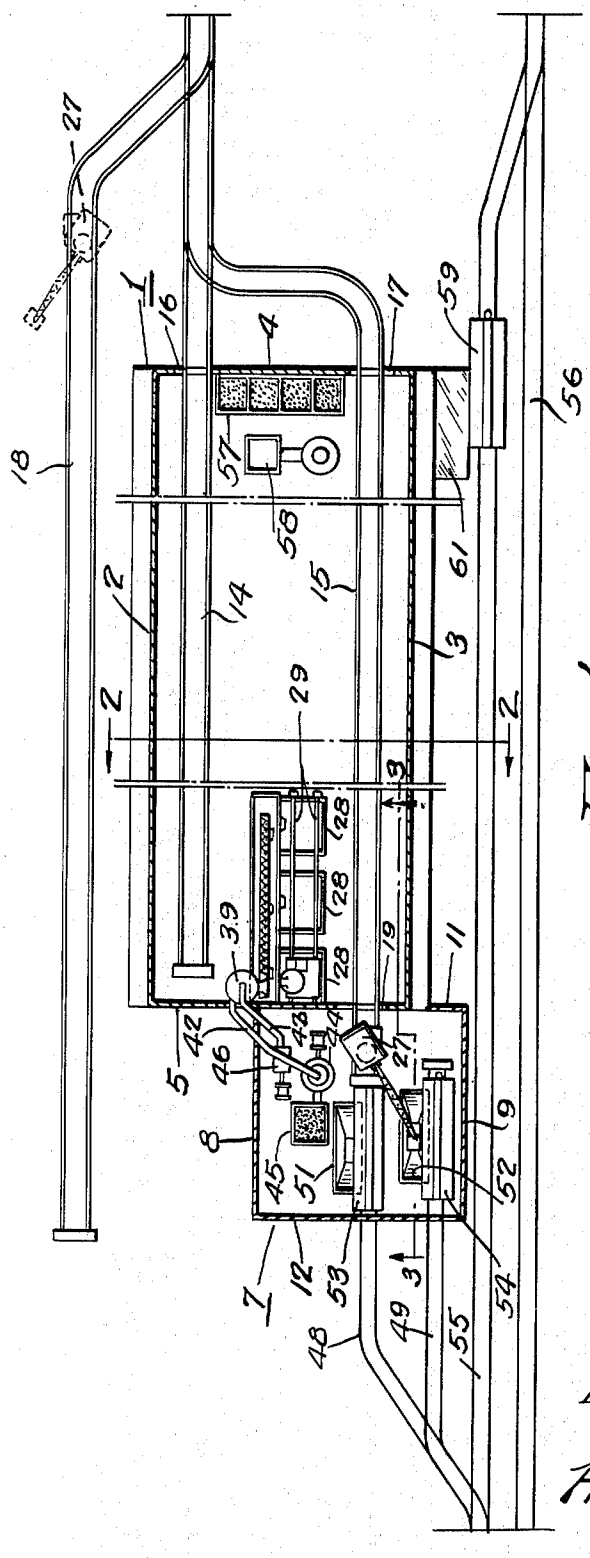


Fig. 1.

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Filed July 25, 1946 3 Sheets-Sheet 2

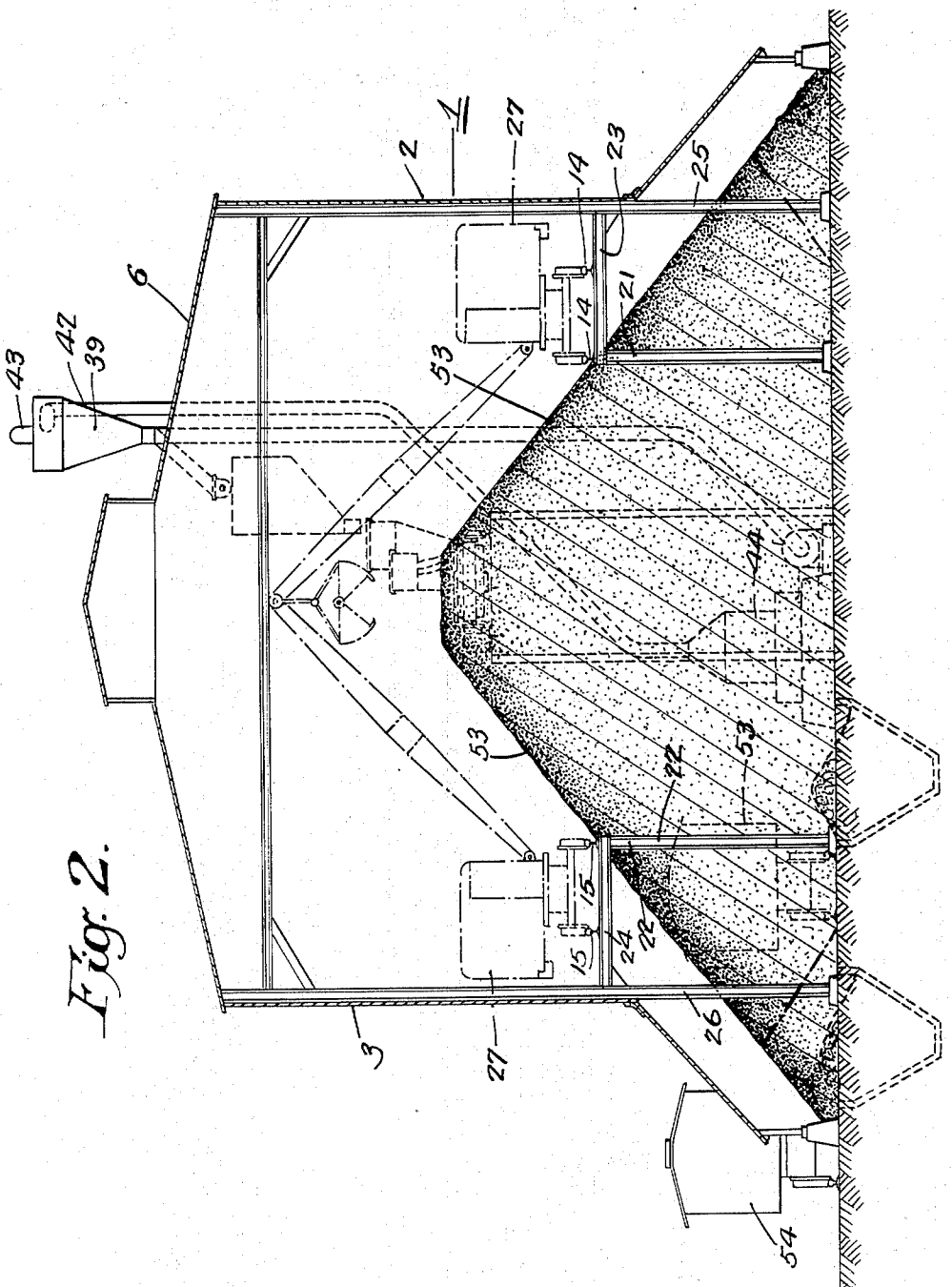


Fig. 2.

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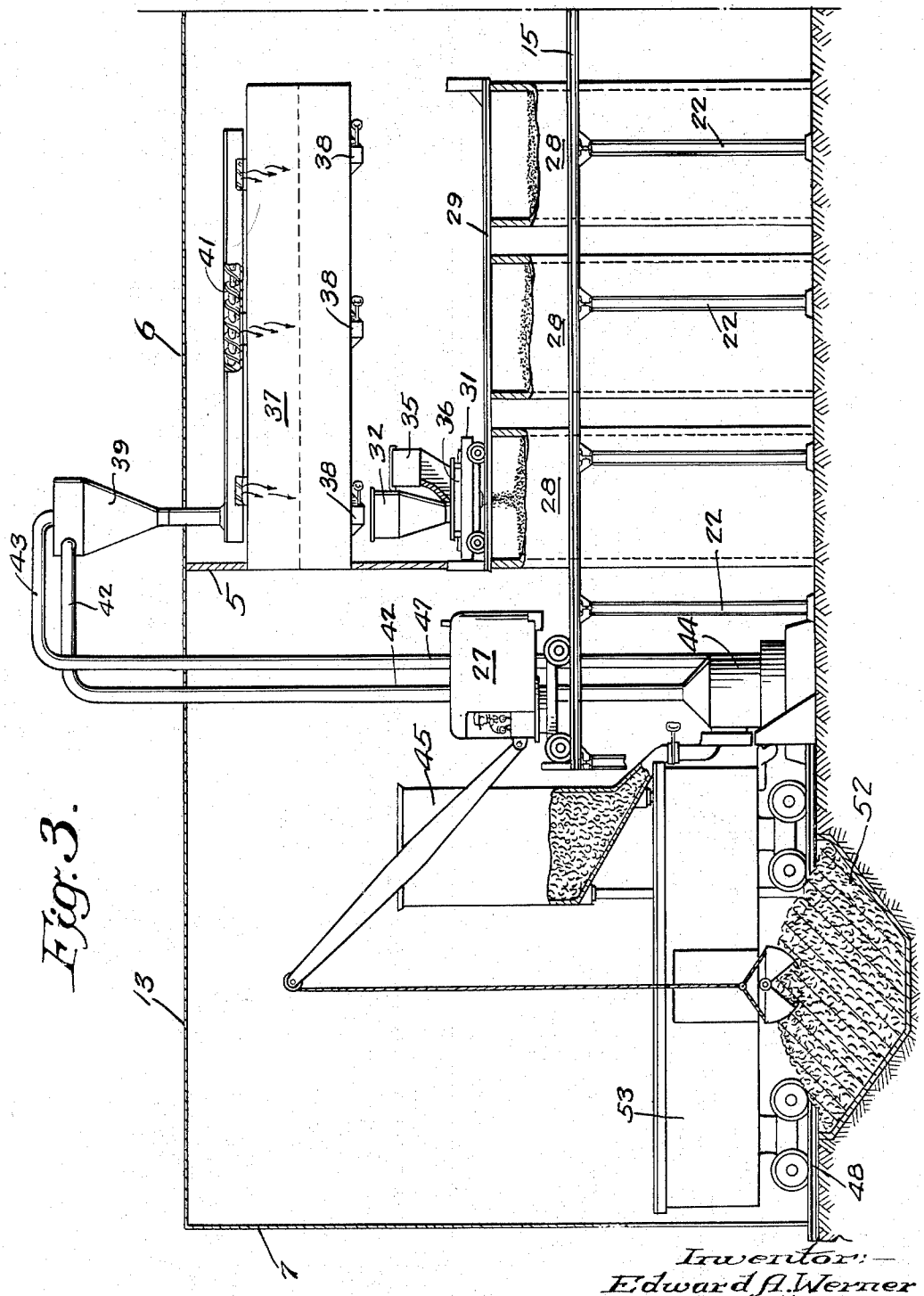


Fig. 3.

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UNITED STATES PATENT OFFICE

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SUPERPHOSPHATE MANUFACTURING PLANT

Edward A. Werner, Atlanta, Ga.

Application July 25, 1946, Serial No. 686,104

11 Claims. (Cl. 23—259.2)

1

This invention relates to improvements in manufacturing plants for acid or superphosphate, and a primary object of the invention is to provide a manufacturing plant of this type of generally improved functional design and construction.

More specifically, an object of the invention is to provide a superphosphate manufacturing plant exhibiting a relatively high degree of economy in construction and operation.

Another object of the invention is to provide a superphosphate manufacturing plant wherein the work material may be handled faster and more economically than in plants constructed in accordance with prior design.

A further object of the invention is to provide a plant of the stated type affording a relatively high degree of flexibility in the handling of the superphosphate materials and in the various manipulations involved in the production and disposal of the end product.

The invention resides further in certain structural details and arrangements hereinafter described and illustrated in the attached drawings wherein:

Fig. 1 is a more or less diagrammatic sectional plan view of a plant constituting a preferred embodiment of the invention;

Fig. 2 is a section on the line 2—2, Fig. 1; and

Fig. 3 is a section on the line 3—3, Fig. 1.

With reference to the drawing, the plant comprises a main building designated generally by the reference numeral 1 and consisting essentially of longitudinal side walls 2 and 3 and end walls 4 and 5 respectively. The transverse and longitudinal sectional forms of this building are illustrated in Figs. 2 and 3. As therein indicated the building is provided also with a roof 6. At one end of this building is an extension 7 which is somewhat off-set from the main structure and which comprises side walls 8 and 9 and end walls 11 and 12, this extension also having a roof 13. The end wall 11 constitutes in effect a continuation of the end wall 5 of the main building.

At each side of the main building 1 and extending within and substantially parallel to the side walls 2 and 3 of this building is an elevated rail track, these tracks being designated respectively by the reference numerals 14 and 15. Both tracks pass through suitable openings 16 and 17 in the end wall 4, and at the outside of the building the track 15 extends transversely to join the track 14 so that, in effect, the track 15 constitutes a branch of the track 14. A second branch 18 extends at the outside and longitudinally of

2

the building opposite the wall 2. The track 14 terminates in the present instance within the building at a point adjacent the end wall 5. The track 15 on the other hand extends through a suitable opening 19 in the end wall 5 into the interior of the extension 7.

With reference to Fig. 2 it will be noted that the tracks 14 and 15 are supported upon trestles, each trestle consisting in the present instance of a series of pillars, 21 and 22 respectively, and beams 23 and 24 which extend from the pillars 21 and 22 to up-rights 25 and 26 which may or may not constitute a part of the fixed framework of the building. Preferably the up-rights 25 and 26 are independent of the building structure to the extent at least that the structure need be heavier in no substantial degree than required for the normal function. In such case the building structure per se may be relatively light and inexpensive.

The elevated tracks 14, 15, and 17 are adapted for reception of a boom crane, or cranes, 27 as illustrated in Figs. 1 and 3 and in broken lines in Fig. 2, and the building and the location therein of the tracks are such that the boom of a crane on either of the tracks 14 and 15 may sweep in excess of one longitudinal half of the building 1 as well illustrated in Fig. 2.

Located within the building 1 adjacent the wall 5 and extending in the present instance longitudinally and centrally of the building is a series of "dens" 28, these dens being three in number in the present instance. Mounted above the dens on rails 29 is a transfer car 31 which carries a weighing hopper 32 for the powdered phosphate rock, an acid weighing boot 35, and a wet mixer 36 which receives the measured portions of the rock and acid from the hopper 32 and boot 35 respectively and after thoroughly mixing these materials passes the resulting superphosphate to the said dens. The car 31 may be moved on the rails 29 to positions over the respective dens for depositing the superphosphate in the latter as desired.

The hopper 32 receives the phosphate rock dust from a bin 37 which overlies the rails 29 and which is provided with valve controlled chutes 38—38, one of which chutes is located over each of the dens as illustrated in a position to deposit the dust in the hopper 32 when the latter is moved to a position above the associated den. The bin 37 receives the rock dust from a separator 39 by way of a screw conveyor 41 at the bottom of the separator. This separator may be of the conventional cyclone type

having connected thereto an inlet duct 42 and discharge duct 43. The separator is located above the roof 36 of the building 1 and the duct 42 extends downwardly through the roof 13 of the extension 7 and is connected to the top of a rock pulverizer 44 installed within the extension chamber 7. This pulverizer receives the phosphate rock from an overhead hopper 45, also within the extension 7, and the rock dust is transferred from the pulverizer 44 by a fan or blower 46 having its suction port connected by way of the discharge duct 43 with the separator 39 as indicated.

Entering the extension chamber 7 through the wall 12 thereof is a pair of rail tracks 48 and 49 and adjoining each of the tracks within the said chamber is a pit, 51 and 52 respectively, these pits being positioned so that they may receive phosphate rock discharged from rail cars 53 and 54 on the tracks 48 and 49 respectively. The said tracks are connected to a siding 55 which extends at one side of and longitudinally of the plant and which in turn connects with a main rail line 56. The terminal end of the elevated track 15 within the extension chamber 7 is located with respect to the pits 51 and 52 so that a boom crane 27 when positioned on the said terminal end portion of the track may operate to empty each of the pits of its rock content and to deposit the said contents into the hopper 45. In operation the rock thus transferred to the hopper is discharged from the latter into the rock mill 44 where it is ground to fine particles which are then withdrawn through the pipe 42 to the separator 39. The separator 39 deposits the pulverized rock into the conveyor 41, the air stream from which the particles have been separated in the separator 39 being withdrawn through the pipe 43. The dust is transferred by the conveyor 41 to the bin 37 from which it may be passed to the weighing hopper 32 for subsequent admixture with the acid drawn from the boot 35. The resulting superphosphate is deposited in the dens 28 as previously described.

Subsequently, in accordance with the conventional practice, the superphosphate is removed from the dens by use of the crane and bucket and piled for storage within the building 1, a pile thus stored within the building being deposited according to its natural angle of repose and is illustrated in Fig. 2. The removal of the superphosphate from the dens to the storage pile is a function of the boom crane or cranes 27 operating on the rails 14 and 15. It is to be noted that the storage pile of the phosphate may extend to the space at the sides of the dens 28 and to the end wall 5 which is constructed as a bulkhead to withstand the strain of the pile imposed thereon.

Within the building 1, at the opposite end from the dens 28, is a set of storage bins 57 and a mixer 58 through the medium of which the superphosphate removed from the storage pile 53 may be mixed with other suitable materials to form a balanced fertilizer. The finished product thus produced is bagged and may then be loaded for transportation upon a rail car 59 on the siding 55, a loading platform 61 being provided at the side of the building 1 as shown in Fig. 1.

It will be noted that in the aforedescribed system of handling and storing the work materials the boom crane 27 does substantially all of the transfer work. It transfers the raw rock material from the pits 51 and 52 to the hopper 45. It then functions to remove the superphosphate after a suitable period from the dens 28 to the storage pile 53. From the storage pile 53 the crane transfers the superphosphate to the mixing bins 57 and mixer 58. With the arrangement shown it is possible for the crane or cranes to reclaim substantially all (approximately 93%) of the superphosphate from the storage pile 53.

I claim:

1. In a superphosphate manufacturing plant, a building housing the essential elements of the plant including a den, apparatus for delivering acidulated phosphate rock material to the den, and storage space for the superphosphate end product, the width of said building being substantially such as to accommodate between the side walls thereof the base of a pile of the superphosphate end product which at normal angle of repose will extend well toward the top of the building, a track extending along one side wall in an elevated position well below the level of the top of said pile but clear of the inclined side of the latter, and a mobile boom crane mounted for travel on said track and having an effective operational range embracing both the den and storage areas, said crane being thereby operative to build said pile, by transfer of the superphosphate product from the den to the storage area, and to reclaim from the pile substantially all of said product.

2. A superphosphate manufacturing plant according to claim 2 wherein the said track is supported on a trestle, the support elements of said trestle more remote to said wall lying within the area embraced by said pile.

3. A superphosphate manufacturing plant according to claim 1 wherein the elevated tracks for the boom crane extend along both side walls of the building to correspondingly increase the size of the area within the operational range of said crane.

4. In a superphosphate manufacturing plant, a structure housing the essential elements of the plant including a den, apparatus for acidulating phosphate rock material and for delivering said acidulated material to the den, a supply source for phosphate rock means including an elevated hopper for conducting the rock material to the acidulating apparatus, storage space for the superphosphate end product, the width of said structure being such as to accommodate between the sides thereof the base of a pile of the superphosphate end product which at the normal angle of repose will extend well toward the top of the said structure, a track extending along a side of the structure in an elevated position well below the top but clear of the inclined side of said pile, and a mobile boom crane mounted for travel on said track and having an effective operational range embracing the den, the storage area, the said source of supply, and the elevated hopper, said crane being thereby operative to transfer rock material from said source to the hopper, to build said pile by transfer of the superphosphate product from the den to the storage area, and to reclaim substantially all of the said product from said pile.

5. In a superphosphate manufacturing plant, a building enclosing a storage area for the superphosphate and having a width to accommodate between the confronting sides thereof the base of a pile of said superphosphate which at normal angle of repose extends well toward the top of said building, a track extending along each side of said area in an elevated position well below the top of said building and of said pile but clear of the sides of the latter, means for interconnecting

said tracks, den means, an unloading area at one end of said building, grinding mechanism including an elevated feed hopper, acidulating apparatus, means for transferring ground phosphate rock from the said mechanism to the acidulating apparatus and from said apparatus to the den means, a mobile crane mounted for travel on the tracks, said crane having an operational range embracing the unloading area and feed hopper for transfer of rock from the former to the latter, and embracing also the den means and substantially all of the storage area for transfer of the superphosphate material from said means to the storage pile and for reclamation of substantially all of the said material from said pile.

6. In a superphosphate manufacturing plant, a building housing essential elements of the plant including a den, acidulating apparatus and means for delivering acidulated phosphate rock from said apparatus to the den, and storage space for the superphosphate end product, the width of said building being substantially such as to accommodate between the side walls thereof the base of a pile of the superphosphate end product which at normal angle of repose will extend well toward the top of the building, a track extending along at least one side wall of the building in an elevated position well below the level of the top of said pile but clear of the inclined side of the latter, one at least of said tracks being extended through an opening in an end wall of said building, a supply source for phosphate rock external to the building in the area of the said track extension, a crusher mounted also externally of the building and in said area, means for transferring crushed rock from the crusher to the acidulating apparatus within the building, and a mobile boom crane mounted for travel on said track and having an effective operational range embracing the den, the storage area, the said rock source and the crusher, and being thereby operative to transfer rock material from the said source to the crusher externally of the building, to transfer the superphosphate product within the building from the den to the storage area, and to reclaim substantially all of the said product from said pile.

7. A superphosphate manufacturing plant according to claim 6 wherein an elevated feed hopper is associated with the crusher externally of the building and within the operational range of the boom crane whereby the crane may operate to transfer the rock from the supply source to the hopper.

8. A superphosphate manufacturing plant according to claim 6 wherein the rock source and

the crusher are housed in a structure outside of said building and into which the said track extends.

9. In a superphosphate manufacturing plant, a building housing essential elements of the plant including a den, a bin for crushed phosphate rock overlying the top of said den, acidulating apparatus interposed between the bin and the top of said den and constituting a medium for transfer of the crushed rock from the bin to the den, and storage space for the superphosphate end product, the width of said building being substantially such as to accommodate between the side walls thereof the base of a pile of the superphosphate end product which at normal angle of repose will extend well toward the top of the building, a track extending along at least one of the side walls of the building in an elevated position well below the top of said pile but clear of the inclined side of the latter, and a mobile boom crane mounted for travel on said track and having an effective operational range embracing both the den and storage areas, said crane being operative to build said pile by transfer of the superphosphate product from the den to the storage area, and to reclaim from the pile substantially all of said product.

10. A superphosphate manufacturing plant according to claim 9 wherein the tracks extend along both side walls of the building and are connected for transfer of the boom crane selectively from one of the tracks to the other.

11. A superphosphate manufacturing plant according to claim 9 wherein the acidulating apparatus occupies a position close to the top of the den and wherein also means is provided for shifting the said apparatus transversely to one side of the den to afford space for operation of the crane in transferring the acidulated product from the den to the storage pile.

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The following references are of record in the file of this patent:

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Certificate of Correction

Patent No. 2,531,798 November 28, 1950

EDWARD A. WERNER

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 4, line 30, for the claim reference numeral "2" read *1*;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of February, A. D. 1951.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.