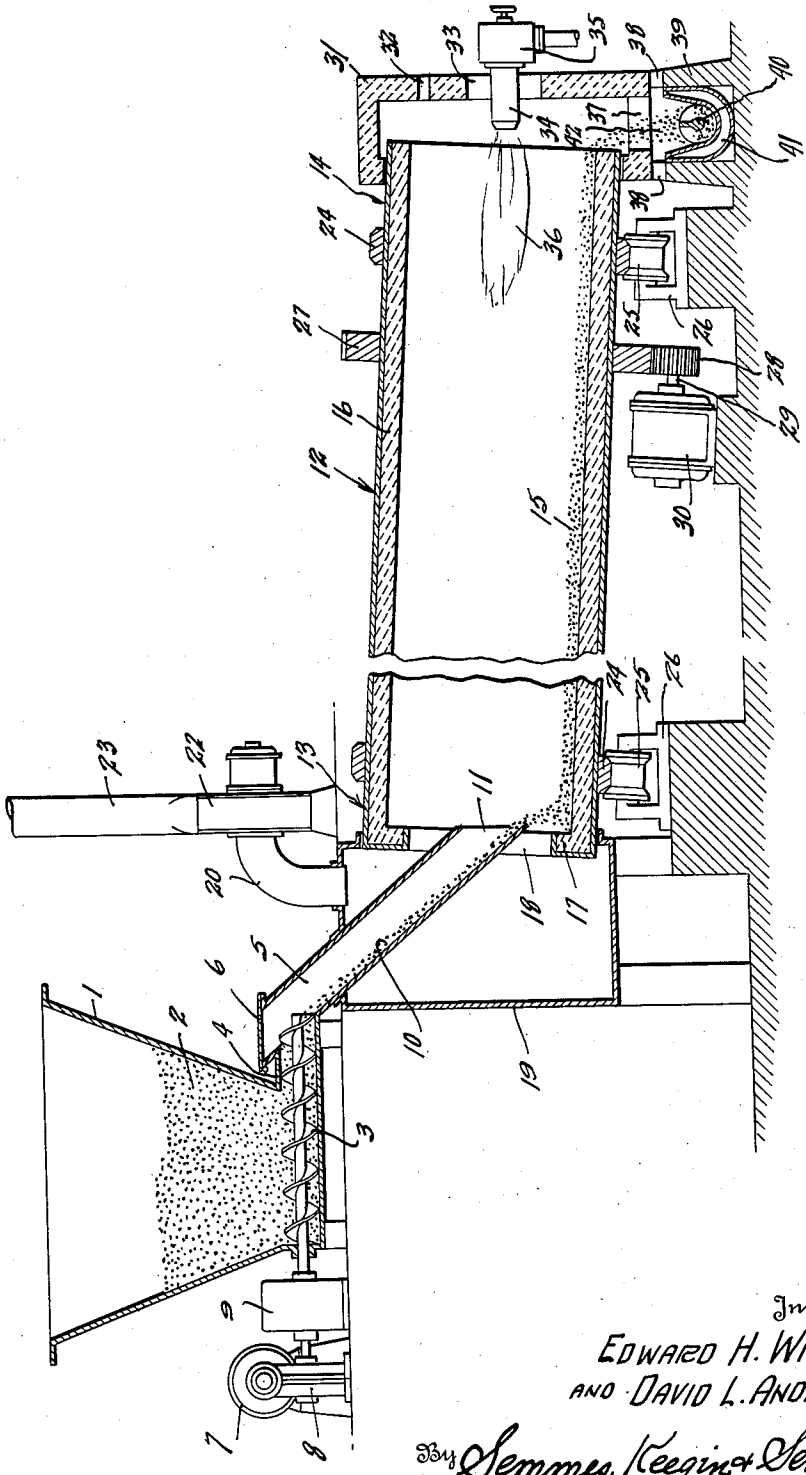
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ANIMAL FEED SUPPLEMENT AND PROCESS OF MANUFACTURE

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ANIMAL FEED SUPPLEMENT AND PROCESS OF MANUFACTURE

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Our invention relates to the manufacture of a mineral supplement for animal feed.

An object of this invention is to produce a calcium and phosphorus containing material suitable for animal feed purposes, by means of a simple process employing a simple inexpensive apparatus of high capacity.

Another object of this invention is to practically eliminate the fluorine from superphosphate to the extent that the fluorine content is greatly reduced over that present in the original superphosphate.

Yet another object of the invention is to provide a process which can be used either with a non-granular superphosphate or preferably with a granular superphosphate as the raw starting material.

Still another object of the invention is to prevent during the process the formation of metaphosphates and to furnish a final product in which the calcium and phosphates are highly soluble in a water solution of 0.4% HCl.

Our process can be used with ordinary den superphosphate or with the granular superphosphate of commerce. The granular superphosphate may be made by one of several processes, but the product itself is one in which there are nodular, globoid granules, each granule having indurated and encrusted surfaces, the granules having a crushing strength several times that of fully cured den superphosphate.

The use of the granular superphosphate presents some advantages over the ordinary den superphosphate in that more even heating can be obtained, a more even contact of the moving gases with the surfaces presented by the granules, and the practical elimination of dust losses. This last item is of considerable importance, and we have found that a process employing the granular superphosphate is highly economical and gives an excellent uniform final product.

The material is fed into a rotary kiln whose axis is inclined to the horizontal so that while the material is tumbled in the rotary kiln it will pass from the high feed end towards the low discharge end.

A burner is located at the lower end of the kiln and hot gases pass up through the kiln towards the high end where they are subjected to the action of an exhaust fan which tends to suck them from the kiln. During their discharge through the kiln the gases give up their heat to the tumbled raw material and calcine this material to a point at which the fluorine is practically eliminated.

The movement of the gases across the material being treated is highly desirable as otherwise a considerable portion of the total P_2O_5 changes to insoluble compounds. In the kiln the temperature in general ranges between 600 and 800° C.

The single figure of the drawing shows an apparatus for carrying out our invention, the drawing being largely in longitudinal section.

Referring to the drawing, we have shown a hopper 1 to which is fed superphosphate by means of a clam shell bucket or other suitable means. The hopper 1 is shown partially loaded with superphosphate, as indicated at 2. In the bottom of the hopper 1 lies a screw conveyor 3, which is adapted to discharge through an outlet 4 in a chute 5. The chute 5 is closed by means of a hinged door 6.

The feed screw 3 is adapted to be driven by means of a motor 7 which, through a reduction gearing 8, drives a variable speed transmission 9. At 10 in the chute 5 is shown superphosphate which passes down the chute 5 and is discharged through a discharge end 11 of the chute 5 into a rotary calciner indicated generally by the numeral 12. The rotary calciner has its axis at a slant to the horizontal, having a high end 13 into which the superphosphate to be calcined is delivered, and a lower end 14 from which the calcined superphosphate is discharged. The superphosphate passing through the rotary calcincer 12 is indicated by the numeral 15.

The rotary calciner 12 is provided with a refractory lining 16. One end of the rotary calciner 12 is restricted, as indicated at 17, and the chute 5 delivers the superphosphate to be calcined through a restricted opening 18 formed at the upper end of the calciner.

Adapted to fit around the upper end of the calciner 12 is an exhaust breeching 19 which, at its upper end is in communication with an exhaust pipe 20 that is connected to an exhaust fan 22. The exhaust fan 22 delivers all exhaust gases through a stack 23.

In order to rotate the calciner 12, we have shown rings 24 adapted to travel in rollers 25 mounted on supports 26. Motive power to move the calciner 12 and give it the desired rotary motion is furnished through a ring gear 27 driven by a pinion 28 which is mounted on a shaft 29 of a motor 30. There may be reduction gearing between the motor 30 and the pinion 28 if desired. A refractory lined breeching 31 is shown at the lower end 14 of the rotary calciner 12. This refractory lined breeching is provided with a peek hole 32 through which the contents of the calciner may be viewed, and an aperture 33 into which sticks a nozzle 34 of a gas or oil burner 35. At 36 is shown the flame of the burner. The temperature of the material in the calciner is maintained somewhere between 600 to 800° C. Secondary air is inducted into the calciner through the aperture 33 and through a discharge opening 37 formed at the lower end

of the refractory breeching 31. Air passes into the opening 37 through apertures 38 formed in a support 39 which carries a screw conveyor 40. The air which passes in through the aperture 33 and through apertures 38 and 37 may be in excess of that required for complete combustion of the fuel, but the moving gases tend to reduce the fluorine content of the superphosphate being treated.

The feed screw 40 is adapted to rotate in the bottom of a water-jacketed trough 41. The calcined superphosphate 42 is partially cooled by the passage of the air through the apertures 38 and 37. From the water-jacketed trough 41 the finished material is discharged to storage.

Typical examples of analyses before and after calcination are as follows:

	Before	After
Total P_2O_5 ---------- percent	22.0	27.2
Fluorine ---------- do	1.47	0.09

It will be noted that the fluorine is substantially completely eliminated (about 95% removal) and the final product preferably contains not more than .1% fluorine. The calcining temperature is from 600 to 800° C. and no fusion whatever takes place. The increase of P_2O_5 percentage during the calcination is due to the elimination of moisture and hydrate water.

It is pointed out that granular superphosphate is particularly suitable for this operation, because of the uniformity of particle size and resultant uniform heating. In addition to this, however, the use of granular superphosphate eliminates troubles due to dust losses. This is of extreme importance from a practical standpoint.

There is no official method for the determination of the digestibility of phosphate compounds used for feeding purposes. A method used in the trade is, however, the determination of solubility in a water solution of 0.4% HCl. The reason for this is that this is the acid and approximate strength of the acidity of the digestive juices. The analytical method involves digesting one gram sample in 100 c.c. at 65° C. for one hour.

By means of this method as well as by feeding experiments our defluorinated phosphate shows practically complete availability, the insoluble P_2O_5 after calcination being only about 0.4% out of a total of 27.2%; or 1.47% of the total P_2O_5. Another way of stating this is to say that 98.53% of the total P_2O_5 is soluble. In other words, from 95% to 98.53% of the total P_2O_5 is soluble.

It is apparently important that the calcination of the superphosphate is performed under conditions where the material is subjected to a moving current of gas.

The simplest means of accomplishing this is of course the use of direct contact with combustion gases as indicated in the accompanying drawing. Other means of subjecting the material to a current of moving gases can be employed.

If the superphosphate is calcined in the absence of gas currents as for instance in an electric oven, as much as one-fourth of the total P_2O_5 changes to insoluble compounds, possibly meta-phosphates, that do not show up as P_2O_5 by the official analytical method. Moreover, the solubility of the calcined material in 0.4% HCl is unsatisfactory, in fact as much as one-half of the P_2O_5 will be insoluble.

We claim:

1. A process for treating superphosphate to render it suitable for animal feed comprising calcining the superphosphate in the presence of heated gas currents between 600 to 800° C. to reduce the fluorine content to not more than .10 percent.

2. In a process for producing animal feed from superphosphates, calcining the superphosphate between temperatures of 600 to 800° C. to remove fluorine and to increase the availability for animal feed of the calcium and phosphorus contents.

3. A process of treating superphosphate comprising calcining the superphosphate between temperatures of 600° to 800° C. in the presence of moving currents of heated gas while agitating the superphosphate to give it a tumbling motion while causing it to move progressively in a given direction with counter-current flow of heated gases to produce an animal feed supplement of low fluorine content.

4. In a process for rendering available for animal food the calcium and phosphorus contents of superphosphate, the step of calcining the superphosphate at temperatures of 600 to 800° C. in a zone of agitation wherein the superphosphate is caused to tumble and have a progressive motion in said zone, while subjecting the superphosphate in its passage through the zone to a counter-current flow of heated gases, whereby the fluorine content is reduced to not more than .1 percent and the P_2O_5 content is rendered soluble in .4 percent HCl to the extent of approximately 98 percent of such P_2O_5 content.

5. A process of producing a cattle feed supplement comprising subjecting granular superphosphate consisting of nodules of encrusted and indurated globoid particles to a calcining step at temperatures between 600° to 800° C. where the particles are subjected to a moving current of heated gases.

6. In a process for producing animal feed supplement from granular superphosphate, calcining the granular superphosphate between temperatures of 600 to 800° C. to remove fluorine and to increase the availability for animal feed of the calcium and phosphorus contents.

7. A process for producing animal feed supplement from granular superphosphate comprising calcining the granular superphosphate between temperatures of 600 to 800° C. in a zone of agitation wherein the superphosphate is tumbled and given a progressive motion in said zone and subjecting the material in its passage through the zone to a counter-current flow of heated gases whereby the fluorine content is greatly reduced and approximately 98 percent of the P_2O_5 content is rendered soluble in .4 percent HCl.

8. In a process for rendering available for animal food the calcium and phosphorus contents of granular superphosphate, the step of calcining the superphosphate at temperatures of 600 to 800° C. in a zone of agitation wherein the superphosphate is caused to tumble and to move progressively in said zone, while subjecting the superphosphate in its passage through the zone to a counter-current flow of heated gases, whereby the fluorine content is reduced to not more than .1 percent and the P_2O_5 content is rendered soluble in .4 percent HCl to the extent of approximately 98 percent of such P_2O_5 content.

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